#1129255545 id: 88074675

HD
221
.034

OFFEROR
DEMONSTRATION
PACKAGE

BUREAU OF LAND MANAGEMENT
ALMRS/MODERNIZATION PROJECT

ODP FOR N-652-RFP1-0002

Historic, archived document.

Do not assume content reflects current scientific knowledge, polices, or practices.

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION **PAGE**

1.0 INTRODUCTION 1
- 1.1 Purpose 1
- 1.2 Overview 1
- 1.3 Compliance with Government Objective 2
- 1.4 Types of Demonstrations 2
  - 1.4.1 Stress Tests 2
  - 1.4.2 Software Re-engineering Activities . . . 3
  - 1.4.3 Functional Demonstrations 3
  - 1.4.4 Reserved 4
  - 1.4.5 Management Reviews 4
- 1.5 Demonstration Configurations 4

2.0 PHASES OF DEMONSTRATION 4
- 2.1 Unwitnessed Demonstrations Phase I 4
  - 2.1.1 Statements of Conformance to Standards . 5
    - 2.1.1.1 POSIX 5
    - 2.1.1.2 SQL 5
    - 2.1.1.3 GOSIP 5
  - 2.1.2 Unwitnessed Performance Stress Test Results 6
  - 2.1.3 Software Re-engineering Management Plan 8
  - 2.1.4 Unwitnessed Demonstrations Phase I Configuration 9
- 2.2 Unwitnessed Demonstrations Phase II 9
  - 2.2.1 Re-engineered Software Source Code . . . 10
  - 2.2.2 Re-engineered Software Documentation . . 11
  - 2.2.3 Physical Data Base 11
  - 2.2.4 Training Materials 12
  - 2.2.5 Unwitnessed Functional Demonstrations . . 12
  - 2.2.6 Unwitnessed Demonstrations Phase II Configuration 13
  - 2.2.7 Witnessed Demonstration Configuration . . 13
  - 2.2.8 Demonstration Schedule 15
  - 2.2.9 Updated Re-engineering Management Plan . 15
- 2.3 Witnessed Demonstrations 15
  - 2.3.1 Witnessed Performance Stress Tests . . . 16
    - 2.3.1.1 Business Benchmark 16
    - 2.3.1.2 Local Area Network Demonstration . . 17
    - 2.3.1.3 Relational Data Base Performance using Remote Terminal Emulation . . 18
  - 2.3.2 Re-engineered Software Training 19
  - 2.3.3 Re-engineered Software Testing 19

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION PAGE

2.3.4 Re-engineered Software Development Review 20
2.3.5 Functional Demonstrations 20
2.3.6 Reserved 20
2.3.7 Management Reviews 20

3.0 EXHIBITS 21

APPENDIX A: RE-ENGINEERING SOFTWARE REQUIREMENTS

1.0 INTRODUCTION A.1
1.1 Purpose A.1
1.2 Overview A.1
1.3 Software Organization A.3

2.0 FUNCTIONAL SPECIFICATIONS A.4
2.1 Select Plat(s) A.5
2.2 Display Plat A.5
2.3 Display Associated Windows A.6
2.4 Select Inspection Items A.7
2.5 Select Plat Themes A.7
2.6 Display Inspection Priority, History, and Well/Facility Information A.7
2.7 Display Visual Overlays A.8
2.8 Adjust View A.8
2.9 Print Window A.9
2.10 Input New Inspection Report and Incidents of Noncompliance (INC) Records A.9
2.12 Save Inspection Item Selections A.10

3.0 EXHIBITS A.10

APPENDIX B: PROCESSING LOAD FOR SOFTWARE RE-ENGINEERING TESTING

1.0 OVERVIEW B.1

2.0 TASK LOAD ORGANIZATION B.1

3.0 CREATION OF WORK FILES B.1

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION **PAGE**

APPENDIX C: FUNCTIONAL DEMONSTRATIONS

1.0 INTRODUCTION C.0-1
  1.1 Purpose C.0-1
  1.2 Overview C.0-1
  1.3 Interaction with Re-engineering Activities . . C.0-1
  1.4 Demonstration Environment C.0-2

2.0 FUNCTIONAL DEMONSTRATIONS C.0-2
  2.1 FD 1 - DISTRIBUTED FILE SYSTEM CAPABILITIES . . C.1-1
    2.1.1 Objective C.1-1
    2.1.2 RFP References C.1-1
    2.1.3 Instructions C.1-1
      2.1.3.1 Script C.1-3
        2.1.3.1.1 Script for Setup C.1-3
        2.1.3.1.2 Script for Advanced Workstation C.1-3
        2.1.3.1.3 Script for Basic Workstation C.1-5
        2.1.3.1.4 Script for Remote Advanced Workstation C.1-5
        2.1.3.1.5 Script for Administrative Workstation C.1-5
        2.1.3.1.6 Script for X-Terminal . . . C.1-5
      2.1.3.2 Data C.1-5
      2.1.3.3 Reserved C.1-6
    2.1.4 Expected Output C.1-6
    2.1.5 Reserved C.1-7

  2.2 RESERVED C.2-1

  2.3 FD 3 - RDBMS DISTRIBUTION C.3-1
    2.3.1 Objective C.3-1
    2.3.2 RFP References C.3-1
    2.3.3 Instructions C.3-1
      2.3.3.1 Script C.3-2
        2.3.3.1.1 Script for Setup C.3-2
        2.3.3.1.2 Script for Initial Execution C.3-2
        2.3.3.1.3 Script for Abnormal Interruption and Subsequent Restoration C.3-3
        2.3.3.1.4 Script for Reconfiguration C.3-4

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION PAGE

2.3.3.1.5 Script for Execution on Reconfigured System C.3-4
2.3.3.2 Data C.3-4
2.3.3.3 Programs C.3-4
2.3.4 Expected Output C.3-6
2.3.5 Reserved C.3-6

2.4 FD 4 - OFFICE AUTOMATION C.4-1
2.4.1 Objective C.4-1
2.4.2 RFP References C.4-1
2.4.3 Instructions C.4-1
2.4.3.1 Script C.4-2
2.4.3.1.1 Steps to be performed on workstation WP-A C.4-2
2.4.3.1.2 Steps to be performed on workstation WD-A C.4-3
2.4.3.1.3 Steps to be performed on workstation WPT-B C.4-3
2.4.3.2 Data C.4-3
2.4.3.2.1 Document C.4-4
2.4.3.3 Reserved C.4-4
2.4.4 Expected Output C.4-4
2.4.5 Reserved C.4-4

2.5 RESERVED C.5-1

2.6 RESERVED C.6-1

2.7 FD 7 - SECURITY C.7-1
2.7.1 Objective C.7-1
2.7.2 RFP References C.7-1
2.7.3 Instructions C.7-1
2.7.3.1 Script C.7-2
2.7.3.1.1 Script for Multi-user Processor Access via Workstation C.7-2
2.7.3.1.2 Script for Multi-user Processor Access via X-Terminal C.7-4
2.7.3.1.3 Script for LAN Access to Multi-user Processors . . . C.7-5
2.7.3.1.4 Script for WAN Access to Multi-user Processors . . . C.7-8
2.7.3.2 Reserved C.7-10

TABLE OF CONTENTS

SECTION **PAGE**

2.7.3.3 Reserved C.7-10
2.7.4 Expected Output C.7-11
2.7.5 Reserved C.7-11

2.8 FD 8 - LANGUAGE INTEGRATION C.8-1
2.8.1 Objective C.8-1
2.8.2 RFP References C.8-1
2.8.3 Instructions C.8-1
2.8.3.1 Script C.8-2
2.8.3.1.1 Setup Script C.8-2
2.8.3.1.2 Script for Workstations . . C.8-3
2.8.3.1.3 Script for Multi-User Processors C.8-6
2.8.3.2 Data C.8-8
2.8.3.3 Programs C.8-8
2.8.3.3.1 ASMSUB.SRC C.8-8
2.8.3.3.2 C__SUB.SRC C.8-8
2.8.3.3.3 COBSUB.SRC C.8-8
2.8.3.3.4 FORSUB.SRC C.8-8
2.8.3.3.5 ASMWSPGM.SRC C.8-9
2.8.3.3.6 C__WSPGM.SRC C.8-9
2.8.3.3.7 FORWSPGM.SRC C.8-10
2.8.3.3.8 GENWSPGM.SRC C.8-11
2.8.3.3.9 ASMMPPGM C.8-12
2.8.3.3.10 C__MPPGM.SRC C.8-12
2.8.3.3.11 COBMPPGM.SRC C.8-13
2.8.3.3.12 FORMPPGM.SRC C.8-14
2.8.4 Expected Output C.8-15
2.8.4.1 ASMWSPGM Output C.8-15
2.8.4.2 C__WSPGM Output C.8-15
2.8.4.3 FORWSPGM Output C.8-15
2.8.4.4 ASMMPPGM Output C.8-16
2.8.4.5 C__MPPGM Output C.8-16
2.8.4.6 COBMPPGM Output C.8-16
2.8.4.7 FORMPPGM Output C.8-17
2.8.4.8 Generated Application Output . . C.8-17
2.8.5 Reserved C.8-17

2.9 FD 9 - CONNECTIVITY C.9-1
2.9.1 Objective C.9-1
2.9.2 RFP References C.9-1
2.9.3 Instructions C.9-1
2.9.3.1 Script C.9-2
2.9.3.2 Data C.9-3

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION PAGE

2.9.3.3 Programs C.9-3
2.9.4 Expected Output C.9-3
2.9.5 Reserved C.9-4

2.10 FD 10 - SYSTEM ADMINISTRATION C.10-1
2.10.1 Objective C.10-1
2.10.2 RFP References C.10-1
2.10.3 Instructions C.10-1
2.10.3.1 Script C.10-2
2.10.3.1.1 Script for Account Management C.10-2
2.10.3.1.2 Script for Automatic Logoff C.10-2
2.10.3.1.3 Script for Magnetic Disk and Tape Device Control . C.10-2
2.10.3.1.4 Script for Optical Disk Device Control C.10-3
2.10.3.1.5 Script for Printer Control C.10-3
2.10.3.1.6 Script for Plotter Control C.10-4
2.10.3.1.7 Script for Remote Access Control C.10-4
2.10.3.1.8 Script for LAN Control . C.10-5
2.10.3.2 Data C.10-6
2.10.3.3 Reserved C.10-6
2.10.4 Expected Output C.10-6
2.10.5 Reserved C.10-6

2.11 FD 11 - BACKUP AND RESTORE C.11-1
2.11.1 Objective C.11-1
2.11.2 RFP References C.11-1
2.11.3 Instructions C.11-1
2.11.3.1 Script C.11-2
2.11.3.2 Data C.11-3
2.11.3.3 Reserved C.11-3
2.11.4 Expected Output C.11-3
2.11.5 Reserved C.11-3

2.12 RESERVED C.12-1

2.13 FD 13 - CPU PRECISION TEST C.13-1
2.13.1 Objective C.13-1
2.13.2 RFP References C.13-1
2.13.3 Instructions C.13-1
2.13.3.1 Script C.13-2

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION PAGE

- 2.13.3.2 Data C.13-3
- 2.13.3.3 Programs C.13-3
- 2.13.4 Expected Output C.13-3
- 2.13.5 Reserved C.13-3

2.14 FD 14 - DISTRIBUTED GIS SUPPORT C.14-1
- 2.14.1 Objective C.14-1
- 2.14.2 RFP References C.14-1
- 2.14.3 Instructions C.14-1
  - 2.14.3.1 Script C.14-2
  - 2.14.3.2 Data C.14-2
  - 2.14.3.3 Reserved C.14-3
- 2.14.4 Expected Output C.14-3
- 2.14.5 Reserved C.14-3

2.15 RESERVED C.15-1

2.16 FD 16 - RASTER DEVICE SUPPORT AND VECTOR FEATURE EDITING C.16-1
- 2.16.1 Objective C.16-1
- 2.16.2 RFP References C.16-1
- 2.16.3 Instructions C.16-2
  - 2.16.3.1 Script C.16-2
    - 2.16.3.1.1 Script for Scanning, Editing, and Hardcopy Generation C.16-2
    - 2.16.3.1.2 Script for Scanned Map . C.16-4
  - 2.16.3.2 Data C.16-5
  - 2.16.3.3 Reserved C.16-5
- 2.16.4 Expected Output C.16-5
- 2.16.5 Reserved C.16-6

2.17 RESERVED C.17-1

2.18 FD 18 - GIS EDGE MATCHING C.18-1
- 2.18.1 Objective C.18-1
- 2.18.2 RFP References C.18-1
- 2.18.3 Instructions C.18-1
  - 2.18.3.1 Script C.18-3
    - 2.18.3.1.1 Script for five 1:24000 scale maps with soils data in different projections and zones C.18-3

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION PAGE

2.18.3.1.2 Script for four 1:100000 scale maps C.18-3
2.18.3.1.3 Script for one map at 1:62500 scale and three at 1:24000 scale C.18-4
2.18.3.1.4 Script for two 1:100000 scale maps with more than 7500 lines each C.18-5
2.18.3.1.5 Script for data crossing two state boundaries . . C.18-5
2.18.3.2 Data C.18-6
2.18.4 Expected Output C.18-6
2.18.5 Reserved C.18-6

2.19 RESERVED C.19-1

2.20 FD 20 - GIS OVERLAY C.20-1
2.20.1 Objective C.20-1
2.20.2 RFP References C.20-1
2.20.3 Instructions C.20-1
2.20.3.1 Script C.20-7
2.20.3.1.1 Script for Test 1 . . . . C.20-7
2.20.3.1.2 Script for Test 2 . . . . C.20-8
2.20.3.1.3 Script for Test 3 . . . . C.20-8
2.20.3.1.4 Script for Test 4 . . . . C.20-9
2.20.3.1.5 Script for Test 5 . . . . C.20-10
2.20.3.1.6 Script for Test 6 . . . . C.20-11
2.20.3.1.7 Script for Test 7 . . . . C.20-12
2.20.3.1.8 Script for Test 8 . . . . C.20-13
2.20.3.1.9 Script for Test 9 . . . . C.20-13
2.20.3.1.10 Script for Test 10 . . . C.20-14
2.20.3.1.11 Script for Test 11 . . . C.20-15
2.20.3.1.12 Script for Test 12 . . . C.20-15
2.20.3.1.13 Script for Test 13 . . . C.20-16
2.20.3.1.14 Script for Test 14 . . . C.20-16
2.20.3.2 Data C.20-16
2.20.3.3 Reserved C.20-16
2.20.4 Expected Output C.20-17
2.20.5 Reserved C.20-17

2.21 FD 21 - GIS OVERLAY VOLUME CAPACITY C.21-1
2.21.1 Objective C.21-1
2.21.2 RFP References C.21-1
2.21.3 Instructions C.21-1

TABLE OF CONTENTS

SECTION PAGE

2.21.3.1 Script C.21-1
- 2.21.3.1.1 Script for Setup C.21-1
- 2.21.3.1.2 Script for Intersection . C.21-2
- 2.21.3.1.3 Script for Union C.21-3
- 2.21.3.1.4 Script for Difference . . C.21-3

2.21.3.2 Data C.21-4
2.21.3.3 Reserved C.21-4
2.21.4 Expected Output C.21-4
2.21.4.1 Polygon Report Format C.21-5
2.21.4.2 Performance Metrics Report Format C.21-5
2.21.5 Reserved C.21-6

2.22 FD 22 - GIS UPDATE C.22-1
2.22.1 Objective C.22-1
2.22.2 RFP References C.22-1
2.22.3 Instructions C.22-1
2.22.3.1 Script C.22-2
- 2.22.3.1.1 Script for Map Registration C.22-2
- 2.22.3.1.2 Script for Digitization . C.22-3
- 2.22.3.1.3 Script for Direct Coordinate Input C.22-3
- 2.22.3.1.4 Script for Topological Structuring C.22-3
- 2.22.3.1.5 Script for Symbol Modification C.22-4
- 2.22.3.1.6 Script for Line Modification C.22-5

2.22.3.2 Data C.22-5
2.22.3.3 Programs C.22-5
2.22.4 Expected Output C.22-6
2.22.5 Reserved C.22-6

2.23 FD 23 - GIS FEATURE TO GRID INTERPOLATION & CONTOURING C.23-1
2.23.1 Objective C.23-1
2.23.2 RFP References C.23-1
2.23.3 Instructions C.23-1
2.23.3.1 Script C.23-2
- 2.23.3.1.1 Script for Objective (a) C.23-2
- 2.23.3.1.2 Script for Objective (b) C.23-3
- 2.23.3.1.3 Script for Objective (c) C.23-3
- 2.23.3.1.4 Script for Objective (d) C.23-4
- 2.23.3.1.5 Script for Objective (e) C.23-4

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION **PAGE**

2.23.3.2 Data C.23-5
2.23.3.3 Programs C.23-5
2.23.4 Expected Output C.23-6
2.23.5 Reserved C.23-7

2.24 RESERVED C.24-1

2.25 FD 25 - GIS RASTER TO VECTOR CONVERSION . . . C.25-1
2.25.1 Objective C.25-1
2.25.2 RFP References C.25-1
2.25.3 Instructions C.25-1
2.25.3.1 Script C.25-1
2.25.3.2 Data C.25-3
2.25.3.3 Reserved C.25-3
2.25.4 Expected Output C.25-3
2.25.5 Reserved C.25-4

2.26 FD 26 - GIS BUFFER ZONE DEVELOPMENT C.26-1
2.26.1 Objective C.26-1
2.26.2 RFP References C.26-1
2.26.3 Instructions C.26-2
2.26.3.1 Script C.26-3
2.26.3.1.1 Script for File TC15 . . C.26-3
2.26.3.1.2 Script for File TC16 . . C.26-4
2.26.3.1.3 First Script for File TC17 C.26-5
2.26.3.1.4 Second Script for File TC17 . . . . C.26-6
2.26.3.1.5 Script for File TC18 . . C.26-7
2.26.3.1.6 Script for File B.TESTRL C.26-8
2.26.3.1.7 Script for File MATT.S and MATT.S.AT C.26-9
2.26.3.1.8 Script for High Volume Buffer Zone - ADS Line Files AD34117 and EH33117 C.26-10
2.26.3.1.9 Script for High Volume Buffer Zone - MOSS Polygon Files SCTWOLFRG and SCTSAGEHL C.26-11
2.26.3.2 Data C.26-12
2.26.3.3 Programs C.26-12
2.26.4 Expected Output C.26-12
2.26.4.1 Polygon Report Format C.26-12
2.26.4.2 Performance Metrics Report FormatC.26-14
2.26.5 Reserved C.26-14

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION **PAGE**

2.27 RESERVED C.27-1

2.28 FD 28 - GIS PROXIMITY C.28-1
  2.28.1 Objective C.28-1
  2.28.2 RFP References C.28-1
  2.28.3 Instructions C.28-1
    2.28.3.1 Script C.28-2
      2.28.3.1.1 Script for File SCTWOLFRG Inside 0.25 Mile Proximity C.28-2
      2.28.3.1.2 Script for File SCTWOLFRG Inside 2 Mile Proximity . C.28-3
      2.28.3.1.3 Script for File SCTWOLFRG Outside 0.25 Mile Proximity C.28-3
      2.28.3.1.4 Script for File SCTWOLFRG Outside 2 Mile Proximity C.28-4
      2.28.3.1.5 Script for Files SCTWOLFRG and MDRWOLFRG C.28-4
    2.28.3.2 Data C.28-5
    2.28.3.3 Reserved C.28-5
  2.28.4 Expected Output C.28-5
    2.28.4.1 Area Summary Report Format . . . C.28-5
    2.28.4.2 Performance Metrics Report Format C.28-6
  2.28.5 Reserved C.28-6

2.29 FD 29 - GIS RECTANGULAR SURVEYS / METES AND BOUNDS C.29-1
  2.29.1 Objective C.29-1
  2.29.2 RFP References C.29-1
  2.29.3 Instructions C.29-1
    2.29.3.1 Script C.29-3
      2.29.3.1.1 Script for First Township Setup C.29-3
      2.29.3.1.2 Script for Subsequent Township Setup C.29-3
      2.29.3.1.3 Script for Metes and Bounds Processing C.29-4
    2.29.3.2 Data C.29-5
    2.29.3.3 Reserved C.29-5
  2.29.4 Expected Output C.29-5
  2.29.5 Reserved C.29-5

2.30 RESERVED C.30-1

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION PAGE

2.31 RESERVED C.31-1

2.32 RESERVED C.32-1

2.33 RESERVED C.33-1

2.34 FD 34 - STANDARDIZED NAME IDENTIFICATION . . C.34-1
- 2.34.1 Objective C.34-1
- 2.34.2 RFP References C.34-1
- 2.34.3 Instructions C.34-1
  - 2.34.3.1 Script C.34-2
  - 2.34.3.2 Data C.34-3
  - 2.34.3.3 Reserved C.34-3
- 2.34.4 Expected Output C.34-4
- 2.34.5 Required Performance C.34-4

2.35 FD 35 - GRAPHICS PERFORMANCE C.35-1
- 2.35.1 Objective C.35-1
- 2.35.2 RFP References C.35-1
- 2.35.3 Instructions C.35-1
  - 2.35.3.1 Script C.35-3
    - 2.35.3.1.1 X-Terminal Script C.35-3
    - 2.35.3.1.2 Workstation Script . . . C.35-3
  - 2.35.3.2 Data C.35-3
    - 2.35.3.2.1 Bitmap Data C.35-3
  - 2.35.3.3 Reserved C.35-3
- 2.35.4 Expected Output C.35-4
- 2.35.5 Reserved C.35-4

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION PAGE

APPENDIX D: GOVERNMENT SUPPLIED DATA

1.0 INTRODUCTION D.1
  1.1 PURPOSE D.1
  1.2 OVERVIEW D.1
  1.3 MEDIA D.2

2.0 LEGAL LAND DATA D.24
  2.1 LEGAL LAND DESCRIPTION (LLD) DATA D.24
    2.1.1 Overview of LLD Data D.24
    2.1.2 File Format of LLD Data D.24
    2.1.3 Filenames of LLD Data D.25
  2.2 CASE DATA D.26
    2.2.1 Overview of Case Data D.26
      2.2.1.1 Current Status Overview D.27
      2.2.1.2 Case Recordation Overview D.27
      2.2.1.3 Mining Claims Overview D.28
    2.2.2 File Formats of Case Data D.28
    2.2.3 Filenames of Case Data D.28

3.0 PLAT DATA D.28
  3.1 PLAT THEMES D.29
    3.1.1 Overview of Plat Themes D.29
    3.1.2 File Formats of Plat Theme Data D.29
    3.1.3 Filenames of Plat Theme Data D.29
  3.2 DIGITAL ELEVATION MODEL (DEM) DATA D.29
    3.2.1 Overview of DEM Data D.29
    3.2.2 File Formats of DEM Data D.29
    3.2.3 Filenames of DEM Data D.30
  3.3 PCCS DATA D.30
    3.3.1 Overview of PCCS Data D.30
    3.3.2 File Formats of PCCS Data D.30
    3.3.3 Filenames of PCCS Data D.30

4.0 DATA DICTIONARY FILE FORMAT D.30

5.0 FUNCTIONAL DEMONSTRATION DATA REQUIREMENTS D.31
  5.1 DISTRIBUTED FILE SYSTEM CAPABILITIES DATA FILES D.31
  5.2 RESERVED D.31
  5.3 RDBMS DISTRIBUTION DATA REQUIREMENTS D.31
  5.4 OFFICE AUTOMATION DATA REQUIREMENTS D.32
  5.5 RESERVED D.33
  5.6 RESERVED D.33

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION PAGE

5.7 SECURITY D.33
5.8 LANGUAGE INTEGRATION D.33
5.9 NETWORK INTEGRATION D.33
5.10 SYSTEM ADMINISTRATION DATA REQUIREMENTS D.33
5.11 BACKUP AND RESTORE DATA REQUIREMENTS D.33
5.12 RESERVED D.33
5.13 CPU PRECISION TEST DATA REQUIREMENTS D.34
5.14 DISTRIBUTED GIS SUPPORT FOR WORKSTATIONS & X-TERMINALS D.34
5.15 RESERVED D.34
5.16 RASTER DEVICE SUPPORT AND VECTOR FEATURE EDITING DATA REQUIREMENTS D.34
5.17 RESERVED D.36
5.18 GIS EDGE MATCHING D.36
5.19 RESERVED D.37
5.20 GIS OVERLAY D.38
5.21 GIS OVERLAY VOLUME CAPACITY D.38
5.22 GIS UPDATE D.38
5.23 GIS FEATURE TO GRID INTERPOLATION & CONTOURING D.39
5.24 RESERVED D.40
5.25 GIS RASTER TO VECTOR CONVERSION D.40
5.26 GIS BUFFER ZONE DEVELOPMENT D.41
5.27 RESERVED D.41
5.28 GIS PROXIMITY D.41
5.29 GIS METES AND BOUNDS DATA REQUIREMENTS D.42
5.30 RESERVED D.42
5.31 RESERVED D.42
5.32 RESERVED D.42
5.33 RESERVED D.42
5.34 NID GENERATION D.42
5.35 GRAPHICS PERFORMANCE D.42

6.0 EXHIBITS D.43

OFFEROR DEMONSTRATION PACKAGE

TABLE OF CONTENTS

SECTION PAGE

APPENDIX E: MANAGEMENT REVIEWS

1.0 MANAGEMENT REVIEW INTRODUCTION E.1
  1.1 PURPOSE E.1
  1.2 OVERVIEW E.1

2.0 PRIME CONTRACTOR MANAGEMENT REVIEW E.1

3.0 SUBCONTRACTOR RELATIONSHIPS MANAGEMENT REVIEW E.2

4.0 PROJECT PLANNING MANAGEMENT REVIEW E.2

5.0 INSTALLATION MANAGEMENT REVIEW E.2

6.0 TRAINING MANAGEMENT REVIEW E.3

7.0 MAINTENANCE MANAGEMENT REVIEW E.3

APPENDIX F: DBMS RTE TEST

1.0 INTRODUCTION F.1
  1.1 SEQUENCE OF EVENTS F.1

2.0 DATABASE SCHEMA F.2
  2.1 TABLE DESCRIPTIONS F.2
  2.2 TABLE RELATIONSHIPS F.4
  2.3 TABLE RECORD COUNTS AND SIZES F.5
  2.4 SCHEMA F.6

3.0 DATABASE QUERIES F.15

OFFEROR DEMONSTRATION PACKAGE

EXHIBITS

EXHIBIT 1: RESERVED EX-1-1

EXHIBIT 2: BUSINESS BENCHMARK PERFORMANCE REQUIREMENTS . EX-2-1

EXHIBIT 3: WITNESSED DEMONSTRATION HARDWARE ARCHITECTURE EX-3-1

EXHIBIT A-1: AIRS HANDBOOK EXCERPTS EX-A-1-1

EXHIBIT A-2: CURRENT PHYSICAL SCHEMA DIAGRAM EX-A-2-1

EXHIBIT A-3: FORM 3160-9 NOTICE OF INCIDENTS OF NONCOMPLIANCE EX-A-3-1

EXHIBIT C-1: CPU PRECISION PROGRAMS FOR FD 13 . . . . EX-C-1-1

EXHIBIT C-2: EXAMPLE OF RASTER COMPARISON EX-C-2-1

EXHIBIT C-3: EDGE MATCHING EXAMPLES FOR FD18 . . . . . EX-C-3-1

EXHIBIT C-4: EXPECTED OUTPUT FOR FD23 . . . . EX-C-4-1

EXHIBIT D-1: RESERVED EX-D-1-1

EXHIBIT D-2: FILE FORMATS OF CASE DATA EX-D-2-1

EXHIBIT D-3: FILENAMES FOR CASE DATA EX-D-3-1

EXHIBIT D-4: PLAT THEME DATA FILES EX-D-4-1

EXHIBIT D-5: FILENAMES OF DEM DATA FILES EX-D-5-1

EXHIBIT D-6: PCCS FILE FORMATS EX-D-6-1

EXHIBIT D-7: FD 29 INPUT FILE FORMATS EX-D-7-1

EXHIBIT D-8: MOSS DATA FILE FORMATS EX-D-8-1

EXHIBIT D-9: ADS DATA FILE FORMATS EX-D-9-1

EXHIBIT D-10: FILENAMES FOR THE PROJECT PACKAGE . . . EX-D-10-1

EXHIBIT D-11: RESERVED EX-D-11-1

EXHIBIT D-12: RESERVED EX-D-12-1

EXHIBIT D-13: RESERVED EX-D-13-1

OFFEROR DEMONSTRATION PACKAGE

EXHIBITS

EXHIBIT D-14: RESERVED EX-D-14-1

EXHIBIT D-15: RESERVED EX-D-15-1

EXHIBIT D-16: RESERVED EX-D-16-1

EXHIBIT D-17: RESERVED EX-D-17-1

EXHIBIT D-18: ADS FILE FORMAT EXAMPLES EX-D-18-1

EXHIBIT D-19: PCCS DATA FILENAMES EX-D-19-1

1.0 INTRODUCTION

1.1 Purpose

This document contains the instructions by the Bureau of Land Management (BLM) to Offerors responding to RFP #N-652-RFP1-0002, regarding the various witnessed and unwitnessed demonstrations which will be required by the Government in the course of proposal evaluation.

1.2 Overview

The broad nature of this hardware, software, and services procurement is such that the Offeror's proposed solution must be tested in a variety of ways. Stress Tests, Functional Demonstrations, and Operational Capability Demonstrations will demonstrate the performance of the proposed hardware and software components as well as the overall performance of the proposed integrated solutions. Offeror performance of various Software Re-engineering Activities, using the proposed software tools and utilities, will demonstrate the software re-engineering capabilities of the Offeror. Management Reviews will demonstrate the Offeror's experience and capabilities in life cycle system support.

BLM application specifications are being prepared for the Offeror's Software Re-engineering Activities. The applications resemble key BLM requirements, yet are greatly simplified in order to make the scope of the software re-engineering process reasonable for implementation as part of an Offeror demonstration.

The applications to be re-engineered are interactive, map-oriented programs exercising the operating environment, as well as the data base management, graphic information management, and other capabilities of the Offeror's proposed solution. The first application represents a simplified version of BLM's Fluid Mineral Inspection and Enforcement Program. The second application represents a simplified plat generation application. Both applications will conform to the operating environment and standards specified in Section C, "Statement of Work", of the RFP. The software to be re-engineered is described in detail in Appendix A, "Software Re-engineering Requirements."

1.3 Compliance with Government Objective

The objective of the Government is to validate the claims of the proposals of all Offerors in a uniform manner. The Offeror will take no action which, in the judgement of the Government, impairs the ability of the Government to achieve this objective.

If any action on the part of the Offeror is deemed by the Government to interfere with this stated objective, whether or not the Offeror intends or acknowledges such interference, the Government may notify the Offeror that the action is unacceptable. Failure to cease or remedy the action to the satisfaction of the Government may result in the Offeror's proposal being rejected. Such failure may result in an unfavorable evaluation of any part of the Offeror's proposal or demonstrations deemed by the Government to be related to, or affected by, the action.

1.4 Types of Demonstrations

The Offeror demonstrations will be composed of five types of activities, spread across three phases. The five types of demonstrations are:

a. Stress Tests,
b. Software Re-engineering Activities,
c. Functional Demonstrations,
d. Operational Capability Demonstrations, and
e. Management Reviews.

The following Sections describe the five types of demonstrations. The Section after those describes the three phases in which these demonstrations will occur.

1.4.1 Stress Tests

Each proposed level of hardware configurations shall be subject to the following stress tests which are provided by Neal Nelson & Associates:

a. Business Benchmark.

b. Local Area Network Demonstration.

c. Relational Data Base Performance using Remote Terminal Emulation.

The Business Benchmark will be run on each of the Offeror's proposed configurations (multi-user processors and workstations) as part of the unwitnessed stress test. Portions of the results submitted will be verified by the Government as a part of the witnessed stress tests. In order to be considered acceptable the proposed solution must pass all Business Benchmark stress tests. Failure to pass the unwitnessed Business Benchmark stress tests shall render the proposed solution unacceptable.

The Local Area Network Demonstration and Relational Data Base Performance using Remote Terminal Emulation will be run as part of the witnessed stress test.

1.4.2 Software Re-engineering Activities

The Offeror will demonstrate his capability to conduct software re-engineering activities. In order to do so, the Offeror will re-engineer the specifications in Appendix A, "Software Re-engineering Requirements." The re-engineered software will be executed under the observation of the Government while other processing is occurring during the witnessed portions of this ODP. Details of this other processing are given in Appendix B, "Processing Load for Re-engineered Software Testing."

In re-engineering the software specifications, the Offeror will only use tools which are proposed in response to the RFP and documented in the Offeror's proposal.

The Offeror will submit the materials and perform the demonstrations over the three phases of demonstration outlined in a subsequent section of this document, in order to demonstrate the Offeror's expertise in the process of re-engineered software development and implementation.

1.4.3 Functional Demonstrations

In addition to the Software Re-engineering Activities discussed above, the Offeror will perform various Functional Demonstrations in order to demonstrate particular capabilities of the Offeror's proposed solution. The same Functional Demonstrations shall be performed by all Offerors. The Functional Demonstrations are described in detail in Appendix C, "Functional Demonstrations."

1.4.4 Reserved

1.4.5 Management Reviews

The Government will require various reviews of the management methods, structures, and processes proposed by the Offeror. The Offeror will brief Government representatives regarding the topics identified in Appendix E, "Management Reviews."

1.5 Demonstration Configurations

The Offeror will document the hardware, software, firmware, and communications equipment configurations in use for all Offeror demonstrations. Each component shall be identified by Contract Line Item Number (CLIN) from the RFP (refer to Sections B.2, "Master CLIN List" and B.6, "Preparation and Format of Cost/Price Proposals").

2.0 PHASES OF DEMONSTRATION

The five types of Offeror demonstrations will be spread across three phases. The first phase, **Unwitnessed Demonstrations Phase I**, is to be submitted with the Offeror's proposal. After review of the proposal and Phase I submission by each Offeror, the Government will proceed to the subsequent phase of demonstrations. The second phase, **Unwitnessed Demonstrations Phase II**, is to be submitted by selected Offerors within 50 days after notification. This Unwitnessed Demonstrations Phase II is designed to freeze Software Re-engineering Activities and Functional Demonstration preparation at the same time for all Offerors, so no Offeror will have the advantage of more time for completion of the Activities or preparation for the FDs. The third phase, **Witnessed Demonstrations**, will occur at a different time for each Offeror. During each Offeror's Witnessed Demonstrations, the Government will send representatives to the Offeror's site to observe the demonstrations.

2.1 Unwitnessed Demonstrations Phase I

The Unwitnessed Demonstrations Phase I shall be submitted by the Offeror with the Offeror's proposal. The Unwitnessed Demonstrations Phase I is designed to provide the Government with basic information on the standard hardware and software proposed by the Offeror. In the Unwitnessed Demonstrations Phase I, the Offeror will deliver the following items:

a. Statements of Conformance to Standards.
b. Unwitnessed Performance Stress Test Results.
c. Software Re-engineering Management Plan.
d. Unwitnessed Demonstrations Phase I Configuration.

Each of the above items is described in a Section below.

2.1.1 Statements of Conformance to Standards

The proposed solution must conform to the standards developed by the National Institute for Standards and Technology regarding Operating System Support, Data Base Management System Definition, and Communications as follows:

2.1.1.1 POSIX

In order to demonstrate conformance with the Government standard for POSIX, the Offeror will submit a statement of the degree to which the proposed solution complies with FIPS PUB 151-1, in accordance with the provisions in all applicable sections of that publication and Section C.4.2.2, "Operating System Certification", of the RFP. The statement shall include the Offeror’s commitment to bring any currently noncompliant portions of the proposed solution into conformance by the time of Contract award.

2.1.1.2 SQL

In order to demonstrate conformance with the Government standard for SQL, the Offeror will submit a statement of the degree to which the proposed solution complies with FIPS PUB 127, in accordance with the provisions in all applicable sections of that publication and Section C.4.4.11, "Data Base Management System Certification", of the RFP. The statement shall include the Offeror’s commitment to bring any currently noncompliant portions of the proposed solution into conformance by the time of Contract award.

2.1.1.3 GOSIP

In order to demonstrate conformance with the Government standard for GOSIP, the Offeror will submit a statement of the degree to which the proposed solution complies with FIPS PUB 146, in accordance with the provisions in all applicable sections of that publication and Section C.5.1, "GOSIP", of the RFP. The statement shall include the Offeror's commitment to bring any currently noncompliant portions of the proposed solution into conformance by the time of Contract award.

2.1.2 Unwitnessed Performance Stress Test Results

The Offeror will submit with his proposal the results of the unwitnessed stress test. This submission shall consist of the results of the Neal Nelson & Associates Business Benchmark. The software for this may be acquired by contacting:

Robin De La Pena
Neal Nelson & Associates
35 East Wacker Drive
Suite 1500
Chicago, Illinois 60601
(312) 332-3242

a. The Offeror will run the required benchmarks from Neal Nelson & Associates on each of the proposed system configurations (multi-user processors and workstations). The results shall be transcribed to the appropriate "Benchmark Results" table from Exhibit 2 and submitted with the Offeror's proposal. The Offeror will also submit a complete copy of each benchmarks' standard printed output.

b. All benchmarks shall be run on the configurations exactly as proposed. At the time the unwitnessed performance stress tests are run, all proposed hardware and software shall be incorporated into the identical system configuration proposed in response to the RFP Section C requirements.

c. In order to be considered as a qualified Offeror, the average completion times recorded during the unwitnessed performance stress tests must be less than or equal to the values specified in Exhibit 2. Failure to meet any one or more of the specified performance level(s) will result in the Offeror's proposal being rejected.

d. The Neal Nelson & Associates Business Benchmark consists of eighteen (18) tests each of which tests different aspects of a computer system. Exhibit 2 "Business Benchmark Performance Requirements" sets forth the minimum performance requirements each system configuration must achieve on each of these tests.

e. The test for the "A" configuration shall be executed with one hundred (100) copies executing simultaneously. When running this test total hardware and software disk cache shall not exceed 6.0 megabytes.

f. The test for the "B" configuration shall be executed with eighty (80) copies executing simultaneously. When running this test total hardware and software disk cache shall not exceed 6.0 megabytes.

g. The test for the "C" configuration shall be executed with sixty (60) copies executing simultaneously. When running this test total hardware and software disk cache shall not exceed 6.0 megabytes.

h. The test for the "D" configuration shall be executed with forty (40) copies executing simultaneously. When running this test total hardware and software disk cache shall not exceed 3.0 megabytes.

i. The test for the "E" configuration shall be executed with twenty (20) copies executing simultaneously. When running this test total hardware and software disk cache shall not exceed 3.0 megabytes.

j. The test for the workstations shall be executed with twenty (20) copies executing simultaneously. When running this test total hardware and software disk cache shall not exceed 3.0 megabytes.

k. The Offeror will provide the Government with the printed standard output of the Neal Nelson's Business Benchmark. This shall include a graph of the proposed system performance for each of the eighteen (18) tests. It shall also include the number of seconds at each of the data points for which minimum performance figures are specified in Exhibit 2.

l. Offerors who do not wish to acquire the Neal Nelson & Associates Business Benchmark may have their proposed configurations tested for the purposes of this RFP by contacting:

Robin De La Pena
Neal Nelson & Associates
35 East Wacker Drive
Suite 1500
Chicago, Illinois 60601
(312) 332-3242

A single test suite of each system configuration will be conducted on a remote basis at no cost to the Offeror.

2.1.3 Software Re-engineering Management Plan

The Offeror will provide a Management Plan which describes the methodology being used to perform the Software Re-engineering Activities (referred to in Section 1.4.2 of this document). This plan will conform to the form and content specified in this Section and in Section J.12.11, "Re-engineering Plan," of the RFP. The information delivered in this document will be the basis for the initial evaluation of the Offeror's understanding of the problem and process of software re-engineering. It will also form part of the basis for evaluating the software re-engineering processes proposed in accordance with Section C.6, "ALMRS Re-Engineering", of the RFP.

The Project Management Software proposed in response to Section C.4.9.9, "Project Management", of the RFP, shall be used to develop and present the Software Re-engineering Management Plan.

The Offeror will include estimates for all phases of the software re-engineering effort, including software programming and documentation, development of training, etc. These shall be in a form to allow later comparison to actual effort expenditures. Estimates shall include estimates of hours required by personnel category as described in Section J.14, "Support Service Disciplines", of the RFP, and estimates of the dates of major milestones. The quality and completeness of the planning process will demonstrate the planning capabilities of the Offeror.

Later, during the Witnessed Demonstrations, the Offeror will update the original Software Re-engineering Management Plan submitted in the Unwitnessed Demonstrations Phase I and compare the actual progress and status of the project. (Refer to Section 2.2.9.)

2.1.4 Unwitnessed Demonstrations Phase I Configuration

For each demonstration in the Unwitnessed Demonstrations Phase I, the Offeror will provide a complete list of the hardware and communications equipment used for the demonstrations, including the CLINs for each item and detailed diagrams and lists of all components and their interconnections. (Refer to RFP Sections B.2 and B.6.)

The Offeror will also provide a complete inventory of software and firmware used for the demonstrations. The checklist shall identify each software or firmware element completely, including CLIN and version or revision level.

Any hardware, software, firmware, or communications equipment component which has a specific version or release level associated with it, regardless of whether it is part of an aggregate which also has a version or release level associated with it, shall be identified in the inventory.

2.2 Unwitnessed Demonstrations Phase II

Those Offerors selected during the proposal evaluation process to go on to Witnessed Demonstrations will be invited to provide Unwitnessed Demonstrations Phase II before Witnessed Demonstrations occur (refer to RFP Section L.46). Upon completion of the Unwitnessed Demonstrations Phase II the Software Re-engineering activities shall cease.

Unwitnessed Demonstrations Phase II is to be submitted by selected Offerors within 50 days after notification. This Unwitnessed Demonstrations Phase II is designed to freeze Software Re-engineering Activities at the same time for all Offerors, so no Offeror will have the advantage of more time for completion of the activities. In the Unwitnessed Demonstrations Phase II, the Offeror shall deliver the following items:

a. Re-engineered Software Source Code.

b. Re-engineered Software Documentation.

c. Physical Data Base.

d. Training Materials.

e. Unwitnessed Functional Demonstrations.

f. Unwitnessed Demonstrations Phase II Configurations.

g. Witnessed Demonstrations Configuration.

h. Demonstration Plan.

i. Updated Re-engineering Management Plan.

Each of the above items is described in a Section below.

During the Unwitnessed Demonstration Phase II, the Offeror will capture and retain all system generation and initialization materials and records, software installation and initialization materials and records, system console logs, and terminal dialogs which contain information relevant to any component of the Unwitnessed Demonstrations Phase II. The Offeror will deliver all such materials to the Government as part of the Unwitnessed Demonstrations Phase II materials.

2.2.1 Re-engineered Software Source Code

The Offeror will deliver the source code developed for the Re-engineered Software. This delivery has been made part of the Unwitnessed Demonstrations Phase II so that all Offerors will cease software re-engineering activities at the same time, rather than at different times according to the order of Witnessed Demonstrations by the various Offerors. This submission will allow the Government's evaluation team to review an example of the software produced by the Offeror and the methodology implemented in the re-engineering cycle. The source code shall meet the requirements of Section F.2, "Documentation", of the RFP.

At the time of the Witnessed Demonstrations, the Government will require that this source code be compiled and the resultant object code be used for the application execution during the Witnessed Demonstrations. The Offeror will provide proof, during the Witnessed Demonstrations, that the source code included in Unwitnessed Demonstrations Phase II and returned by the Government for the Witnessed Demonstrations is in fact what is compiled and executed for the Witnessed Demonstrations.

Source code shall be understood to mean any control statements which determine the operation of the proposed system beyond the basic operation of its standard operating system and associated utilities and processes. This includes, but is not limited to, source code used as input to assemblers and higher order language translators, e.g., compilers and interpreters, source code used as input to preprocessors such as data base management system language processors, command files, batch files, and job control language of any sort.

As part of the Re-engineered Software Source Code, the Offeror will provide the names and titles of the personnel who performed the development of the re-engineered software, and a description their individual roles in the development.

The Offeror will provide complete identification of the software development tools and utilities used in the development of the re-engineered software. The Offeror will include the CLIN, version number, and release date of all components of the operating system and each software development tool and utility used (refer to RFP Sections B.2 and B.6.) This includes, but is not limited to, library routines either linked to or called by either the operating system or the object code produced by language translators.

2.2.2 Re-engineered Software Documentation

The Offeror will develop and submit documentation of the re-engineered software developed. It shall agree with the training materials delivered with it. It shall fully describe the operation and behavior of the re-engineered software as that operation and behavior will later be observed during Witnessed Demonstrations.

2.2.3 Physical Data Base

The Offeror will submit the physical implementation of the data base in the form of backup or unload tapes containing the entire data base. This is done in order to force all Offerors to freeze development of the data structures and data management tools involved in the re-engineering of the applications.

At the time of the Witnessed Demonstrations, the Government will require that the data from these backup or unload tapes be reloaded onto the system under test. The Government will require, during the Witnessed Demonstrations, that the data base implementation submitted to the Government in Unwitnessed Demonstrations Phase II is being used, without modification, in the Witnessed Demonstrations.

The Offeror will describe any modification of Government provided data necessary for execution of the FDs or re-engineered software on the proposed hardware and software platform. For explanation of which minor modifications are permitted and what modifications are not permitted, refer to Appendix D, Section 1.2, Government Supplied Data.

2.2.4 Training Materials

The Offeror will provide Computer Based Training (CBT) (refer to RFP Section C.10.7, "Training Media and Methods") materials which include a hands-on, stand alone tutorial addressing all user selected functions contained in Appendix A, paragraphs 2.1 through 2.12. All CBT materials shall be compatible with the re-engineered software they support and shall be demonstrated on the same hardware. A training course in the use of the re-engineered software shall later be conducted for selected Government representatives during the Witnessed Demonstrations before the re-engineered software is submitted to live testing. Process-oriented user guides shall be provided for these activities. Course outlines, student materials, etc., shall be provided for Government evaluation. A proposed plan for the evaluation and validation of this skills development activity shall also be provided. The training program shall be targeted to the end user of the re-engineered software and shall ensure that the end user can make full use of the software.

The training materials shall be submitted to the Government during the Unwitnessed Demonstrations Phase II. Those materials will then be returned to the Offeror during the Witnessed Demonstration for use without modification for training at that time.

2.2.5 Unwitnessed Functional Demonstrations

In the Unwitnessed Demonstrations Phase II, the Offeror will provide the Government with the products (scripts, screen dumps, hardcopy output, etc.) from the Functional Demonstrations identified in Appendix C, "Functional Demonstrations." The Offeror will also provide the Government with comprehensive references to technical documentation of all products used in the FDs, so as to document the product capabilities being demonstrated. These unwitnessed results will allow the Government evaluation team to become familiar with the format of the results of the FDs prior to the start of the Witnessed Demonstrations. All Functional Demonstrations shall be performed in full in the Witnessed Demonstrations.

2.2.6 Unwitnessed Demonstrations Phase II Configuration

For each demonstration in the Unwitnessed Demonstrations Phase II, the Offeror will provide a complete list of the hardware and communications equipment used for the Unwitnessed Demonstrations Phase II, including CLINs for each item and detailed diagrams and lists of all components and their interconnections (refer to RFP Sections B.2 and B.6.)

The Offeror will also provide a complete inventory of software and firmware used for the Unwitnessed Demonstrations Phase II. The checklist shall identify each software or firmware element completely, including CLIN and version or revision level. Any hardware, software, firmware, or communications equipment component which has a specific version or release level associated with it, regardless of whether it is part of an aggregate which also has a version or release level associated with it, shall be identified in the inventory.

The same computer system components which are used in the Unwitnessed Demonstrations Phase II shall be used in the Witnessed Demonstrations.

2.2.7 Witnessed Demonstration Configuration

For each demonstration to be made later in the Witnessed Demonstrations, the Offeror will provide a complete list of the hardware and communications equipment which will be in place for the Witnessed Demonstrations including CLINs for each item and detailed diagrams and lists of all components and their interconnections. Any hardware or equipment which will be physically present, but either physically disconnected from the System Under Test or rendered inoperative during the Witnessed Demonstrations must also be identified and annotated in the hardware and equipment checklist.

The hardware shall be configured according to the logical architecture specified in Exhibit 3, "Witnessed Demonstration Hardware Architecture." Exhibit 3 lists the types of equipment necessary for the Witnessed Demonstrations and identifies the number of units of each type which shall be configured on each of three local area networks. The same type of equipment may be disconnected from one LAN and reconnected to another for different demonstrations if necessary, assuming that it is not needed on both LANs simultaneously for any single demonstration.

Where necessary, one type of equipment used in one demonstration may be reconfigured to become another type of equipment for another demonstration, assuming that both types are not needed simultaneously by any demonstration. An example of this type of reconfiguration is the reconfiguration of a class "A" multi-user processor into a class "B" multi-user processor by the reduction of processor capacity, storage capacity, etc.

Such reconfiguration or reconnection is not required, but it is allowed, as long as the resultant configurations adhere to that portion of the logical architecture required for any given demonstration. Any equipment reconfiguration or reconnection shall be documented in the Demonstration Plan described below.

The architecture described in Exhibit 3 is sufficient to support all required Demonstrations; no additions, deletions, or changes shall be made to this architecture. The individual hardware, software, firmware, and communications equipment components used in the Witnessed Demonstrations must be the same as those used in the Unwitnessed Demonstrations Phase II.

The Offeror will also provide a complete inventory of software and firmware to be used in the Witnessed Demonstrations. The checklist shall identify each software or firmware element completely, including version or revision level.

Any hardware, software, firmware, or communications equipment component which has a specific version or release level associated with it, regardless of whether it is part of an aggregate which also has a version or release level associated with it, shall be identified in the inventory.

This inventory will serve as an aid to physical verification of the demonstration configuration at the outset of the Witnessed Demonstrations, and as necessary thereafter. No hardware, communications equipment, software, or firmware shall be present during Witnessed Demonstrations that is not identified on the inventories submitted at this time.

The Offeror will identify all hardware and software included on each configuration involved in the LAN Demonstration and the Relational Data Base Performance Test, including the release number of all software; the parameters used to set all variable items, e.g., buffer sizes, swap areas, physical and logical block sizes, disk cache sizes, etc.; all "tuning" parameters (operating system and other proposed software); and any other factors which could affect system performance, e.g., file indexing scheme, prearrangement of data on a disk, etc.

2.2.8 Demonstration Schedule

The Offeror will present a schedule for performance of Witnessed Demonstrations. The schedule shall allow for Government verification of reconfiguration or reconnection of equipment between demonstrations.

The Demonstration Schedule shall include a proposed schedule for the Functional Demonstration performance.

The Demonstration Schedule shall include a list of documents which the Offeror will provide during the Witnessed Demonstrations in order to document the Witnessed Demonstrations.

2.2.9 Updated Re-engineering Management Plan

The Offeror will present an update of the Software Re-engineering Management Plan submitted as part of Unwitnessed Demonstrations Phase I. The proposed project management software shall be used to develop and present the updates to the management plan. The update shall reflect events since publication of the original Plan and provide actual hours and completion dates.

2.3 Witnessed Demonstrations

In the Witnessed Demonstrations, the Offeror will perform the following demonstrations under the observation of Government representatives:

a. Witnessed Performance Stress Tests.

b. Re-engineered Software Training.

c. Re-engineered Software Testing.

d. Re-engineered Software Development Review.

e. Functional Demonstrations.

f. Operational Capability Demonstrations.

g. Management Reviews.

Each of the above items is described in a Section below.

During the Witnessed Demonstration, the Offeror will capture and retain all system generation and initialization materials and records, software installation and initialization materials and records, system console logs, and terminal dialogs which contain information relevant to any component of the Witnessed Demonstrations. The Offeror will deliver all such materials to the Government as part of the Witnessed Demonstration materials.

At the time of Witnessed Demonstrations, the Government may, at its discretion, provide new data as a supplement to or amendment of Appendix D, "Government Supplied Data." Any new data files will be in the same format as that supplied originally in Appendix D but may have different content. The new data shall be used for Re-engineered Software Testing.

2.3.1 Witnessed Performance Stress Tests

The witnessed performance stress test shall consist of a series of tests conducted in the presence of Government representatives. The Government will supply and install the Benchmark software used to retest the Unwitnessed Performance Stress Tests.

2.3.1.1 Business Benchmark

The first portion of the witnessed performance stress test shall consist of a rerun of all or of selected portions of the Neal Nelson & Associates Business Benchmark.

In order for a proposal to be considered further, all tests must be completed during the witnessed portion of the demonstration at a performance level equal to or faster than the maximum acceptable seconds documented in Exhibit 2. Performance at a level slower than the levels documented in Exhibit 2 shall result in the Offeror's proposal being rejected.

2.3.1.2 Local Area Network Demonstration

The Offeror will provide fully configured (all proposed hardware and software) systems available for a Local Area Network (LAN) Demonstration. This demonstration shall be performed by Government representatives with the technical support of the Offeror. The total disk cache and LAN buffers on all kernels shall not exceed 3.0 megabytes. This demonstration does not use the same configuration as defined in the Exhibit 3 and shall be configured separately.

The LAN demonstration consists of the following:

a. Twenty (20) of the Offeror's proposed workstations connected to the Offeror's proposed LAN. Each such workstation shall be fully configured with all hardware and software as proposed.

b. The Offeror's largest proposed system, i.e. the "A" system, connected to the same LAN and serving as a file server.

c. Each workstation shall execute a single copy of the Government specified Neal Nelson & Associates Business Benchmark in which all disk files (control file, results files, and twenty (20) work files) are located on the server. All "disk I/O" performed by the business benchmark program shall take place on the server via the local area network.

d. The LAN Demonstration shall be executed through twenty (20) cycles. The first cycle shall have a single workstation active. Each subsequent cycle shall add one active workstation. The final cycle of the LAN Demonstration shall have twenty (20) active workstations.

e. The "parent process" which controls the Business Benchmark test session may, at the option of the Offeror;

1. Be run on one of the 20 workstations.
2. Be run on the server.
3. Be run on an additional 21st workstation connected to the LAN.

2.3.1.3 Relational Data Base Performance using Remote Terminal Emulation

The Offeror will provide fully configured (all proposed hardware and software) systems for the conduct of a Relational Data Base Performance Test. This test shall be performed by Government representatives with the technical support of the Offeror.

The Relational Data Base Management System (RDBMS) performance test shall make use of a Remote Terminal Emulation (RTE) package. Each system configuration shall be tested at the maximum number of user copies that particular configuration is required to support.

The code to be executed, the data to be used, the indexing scheme, and the number of user copies to be executed on each configuration is in Appendix F, "DBMS RTE Test." The entire test is coded in standard SQL. It is the sole responsibility of the Offeror to assure that the provided code functions on all proposed systems. Any and all changes to the code which is provided by the Government will be approved by the Government 21 days prior to the beginning of the Witnessed Demonstrations. Changes made to the code without the specific prior approval of the Government will result in the test being declared invalid and the Offeror's proposal being removed from further consideration.

The RDBMS tests shall be conducted using RTE hardware and software provided by Neal Nelson & Associates. Upon request, the Government will provide to the Offeror, in advance, the instructions to be issued to the RTE system. These instructions shall define the activity at each emulated terminal including the stream to be transmitted, the keying rate, the think time between transactions, and the expected response.

The completion time shall be measured from the time the command is released until the last character of the response is received. No messages which are not an integral part of the requested data may be sent by the system under test.

The Offeror will provide a number of standard RS-232C connectors equal to the maximum number of user copies required for each DBMS RTE test. These RS-232C ports shall be configured for ASCII asynchronous data terminals. Each port shall be configured at 9600 baud.

2.3.2 Re-engineered Software Training

The Offeror will conduct a class using the Training materials submitted to the Government in the Unwitnessed Demonstrations Phase II. The class shall be conducted before the Re-engineered Software is submitted to live testing. It shall cover all features of the operation and behavior of the Re-engineered Software which are scheduled to be examined during live testing.

The class shall include the computer based training and hands-on tutorials specified in Section 2.2.4.

2.3.3 Re-engineered Software Testing

During the Witnessed Demonstrations, the Government will specify test values and procedures to be executed for Re-engineered Software testing to demonstrate that the Re-engineered Software meets the requirements defined in Appendix A, "Software Re-engineering Requirements." The Re-engineered Software shall be executed on a workstation of each type proposed and a host machine of each type proposed. Concurrent with the execution of the Re-engineered Software test a series of commands will be executed on the host machine by the Government supplied Remote Terminal Emulator. A list of these commands and parameters is included in Appendix B "Processing Load for Re-engineered Software Testing."

The Offeror will provide proof, during the Witnessed Demonstrations, that the source code and data bases used to produce and test the executable program(s) used in the Witnessed Demonstrations are identical in every respect to those returned by the Government from the Offeror’s submissions in the Unwitnessed Demonstrations Phase II.

At the time of Witnessed Demonstrations, the Government may, at its discretion, provide new data as a supplement to or amendment of Appendix D, "Government Supplied Data." Any new data files or materials will be in the same format as those supplied originally in Appendix D, but may have different content. If new data is supplied, it shall be used for Re-engineered Software Testing.

2.3.4 Re-engineered Software Development Review

The Offeror will present a Re-engineered Software Development Review which shall cover all stages of the Re-engineered Software development effort. The Offeror will review the original Software Re-engineering Management Plan submitted in the Unwitnessed Demonstrations Phase I and the update submitted in Phase II and compare the actual progress and status of the project, using the proposed project management software. The Offeror will review any revisions of the plan and demonstrate the Offeror's capability both to follow a project plan and to change/update a project plan.

The review shall identify all the individuals involved in the Software Re-engineering Activities and demonstrate whether the key personnel identified in the proposal are the same personnel who have been involved in the Software Re-engineering Activities. The review shall describe the involvement of each person in the Software Re-engineering Activities and present the actual time records of those personnel and compare them to the projections contained in the Software Re-engineering Management Plans submitted in Unwitnessed Demonstrations Phase I and Phase II.

2.3.5 Functional Demonstrations

In the Witnessed Demonstrations, the Offeror will perform the Functional Demonstrations identified in Appendix C, "Functional Demonstrations."

At the time of Witnessed Demonstrations, the Government may, at its discretion, provide new data as a supplement to or amendment of Appendix D, "Government Supplied Data." Any new data files will be in the same format as that supplied originally in Appendix D, but may have different content. The new data shall be used for the Functional Demonstrations.

2.3.6 Reserved

2.3.7 Management Reviews

During the Witnessed Demonstrations, the Offeror and the Government will perform the Management Reviews specified in Appendix E, "Management Reviews."

3.0 EXHIBITS

The exhibits for the main Section of the Offeror Demonstration Package, as well as those for the appendices, occur at the end of the document, after all the appendices.

APPENDIX A: RE-ENGINEERED SOFTWARE REQUIREMENTS

1.0 INTRODUCTION

1.1 Purpose

This document contains requirements/specifications to be re-engineered into application software as part of the Offeror Demonstrations associated with proposals submitted in response to RFP #N-652-RFP1-0002. This document does not increase the functional requirements for the proposed system specified in the RFP. It is only used for ODP purposes.

1.2 Overview

Offerors submitting proposals in response to the RFP are required to demonstrate their software development capabilities by programming and documenting Re-engineered Software in accordance with the requirements in this document. Offerors are to develop the Re-engineered Software using the methodology proposed in response to RFP Section C.6, ALMRS Re-engineering. In the following sections of this document, the Government provides a set of functional specifications. In response, the Offerors are to produce programming, documentation, and training materials which adhere to the requirements of this document and the RFP, and then perform software training and testing as specified in the Offeror Demonstration Package.

This Re-engineered software requirement represents one type of processing performed by the Bureau of Land Management (BLM). The Automated Inspection Record System (AIRS) was designed to provide automated support for the BLM Fluid Mineral Inspection and Enforcement program. Its primary function is to increase inspectors' field time by reducing the time spent collating inspection criteria information. In addition, it makes data and information available to management so that they can better manage the Inspection and Enforcement program.

Futher explanations of the functionality is contained in Exhibit A-1-2.

Re-engineered Software requirements of this document are represented by a set of data files provided by the Government and described in Appendix D of the Offeror Demonstration Package.

The Plat Theme information is used to select Inspection Items.

The Re-engineered Software is to provide graphic presentation of the Inspection Item and Plat Theme information. The Inspection Item locations are identified by Legal Land Descriptions (LLDs). Legal Land Descriptions provide the locational information to determine which plats are to be displayed. Plats are diagrams of the parcels of land in a given area. The parcels of land on a plat correspond to the Legal Land Descriptions in Inspection Items involving land in the area covered by the plat.

Plat Themes are related to geographic areas by coordinates. One function of the Re-engineered Software is the correlation of Plat Themes with Legal Land Descriptions and geographic coordinates generated by the Public Land Survey System Computational Coordinate System (PCCS) in order to allow the graphic display of both Inspection Items and Plat Themes on the same plat. In order to facilitate display and printing of Inspection Items and Plat Themes superimposed together, the Offeror will project both types of data into a Universal Transverse Mercator projection. The Offeror may use the U.S.G.S. projection package supplied by the Government, or an equivalent package, to accomplish this. The source code of the U.S.G.S. projection package occurs in file PROJPACK.SRC in Appendix D, "Government Supplied Data."

The Re-engineered Software shall be compatible with all proposed multi-user processors, workstations, and terminals proposed in response to the requirements found in Section C of the RFP. During the Witnessed Demonstrations, the Re-engineered Software shall be demonstrated on all the processors, workstations, and an X-Terminal, in the configurations defined in the Offeror Demonstration Package. The Government will select certain configurations on which to perform detailed testing of the Re-engineered Software, in accordance with the Re-engineered Software Testing section of the Offeror Demonstration Package. The Government will also select other configurations on which to perform less rigorous testing for the purpose of confirming software compatibility with the proposed configurations.

1.3 Software Organization

A functional characteristic of the software is the ability to visually display information related to inspection items on plats. The following is a sequential list of actions which the software must be capable of performing.

a. Select the plat to be displayed by entering the MTR for each township to be included, or selecting one or more townships from all available MTR's either graphically from a large scale plat or textually from a dialog box.

b. Display, in a graphic window, the selected MTR plat.

c. Display, in a separate text window, a list of the existing Inspection Item Identifications (IID's) Numbers, with their MTRSQ locations, found in the selected MTR plat.

d. Select/deselect, from this list, IID's to be inspected.

e. Display and label with the IID number on the selected MTR plat, the MTRSQ locations, down to Quarter-Quarter Section, of all IID's currently selected.

f. Overlay the selected MTR plat with the Plat Themes such as the transportation (roads) theme for the MTR plat selected.

g. Display, in a second text window, the current year inspection priorities, and date of last inspection (inspection history close date) for each of the currently selected IID's in the first text window. Whenever the view is adjusted, as described below, update this second text window.

h. Display, in a third text window, the current inspection history records for each of the currently selected IID's in the first text window. Whenever the view is adjusted, as described below, update this third text window.

i. Display, in a fourth text window, the well/completion records and the facility records for the IID's selected for inspection. If there are too many individual wells or facilities to be inspected in one day (subjective judgement), reduce the number of IID's to be inspected by deselecting one or more of the IID's. Whenever the view is adjusted, as described below, update this fourth text window.

j. Display, in a fifth text window, the list of Plat Themes which apply to any LLD in the plat(s) displayed. Whenever the view is adjusted, as described below, update this fifth text window.

k. Manually determine two or three IID's for inspection, based on current year inspection priorities (highest priorities first), date of last inspection (most recent inspections last) and proximity to other IIDs and to existing access roads.

l. All text windows and the plat graphic window will display data only for the currently selected IID's. If, at any time, a IID is deselected from the list of available IID's, all other windows will be updated to reflect only the IID's still selected.

m. Display/Print the selected plat showing the MTRSQ's with IID's selected for inspection and all selected Plat Theme overlays.

n. Display/Print an Inspection Report for each IID selected for inspection.

o. Input new inspection report for IID's inspected. Input minor INC for one of the IID's inspected.

p. Print new inspection report reflecting updated inspection history and outstanding INC's.

2.0 FUNCTIONAL SPECIFICATIONS

With these specifications, the Offeror will develop a COTS based application system consisting of a data base; Graphical User Interface; and various input, edit and output processing routines.

Data fields to which references are made in the following functional specifications are described in detail in Appendix D of the Offeror Demonstration Package, entitled "Government Supplied Data." The data supplied by the Government will have been loaded into the proposed system prior to the execution of the Re-engineered Software. The Re-engineered Software shall access and manipulate the data by invocation of routines within the proposed data base management system (DBMS) (refer to RFP Section C.4.4, "Data Base Management System") and/or geographic information system (GIS) (refer to RFP Section C.4.3, "Geographic Information System.")

The Re-engineered Software developed by the Offeror will be a single X-Windows application. It will be developed using proposed language processors which adhere to the requirements of RFP Section C.4.6, "Language Processors," and the proposed data base management system (refer to RFP Section C.4.4) and the proposed Geographic Information System (refer to RFP Section C.4.3.) The user interface will adhere to the requirements of RFP Section C.4.10, Graphical User Interface, and C.4.11, Graphics Software.

The functions specified below represent the primary functions to be performed by the Re-engineered Software. They may be arranged as entries on a menu, as functions invoked by key sequences, as actions associated with on-screen buttons, or otherwise, in accordance with the requirements of RFP Section C.4.10, Graphical User Interface.

2.1 Select Plat(s)

This function will be the first one executed by the Re-engineered Software. The user will select a plat or plats by entering into a text window the Meridian, Township, and Range (MTR) components of the LLDs. The plat or plats may also be selected by pointing to one or more MTR combinations in a dialog box, or to one or more plat locations on a larger scale plat, either of which display all available MTR locations. (Refer to Section 1.3(a).)

2.2 Display Plat

The Select Plat(s) function must have been performed prior to execution of this function. This function will be performed automatically after completion of any of the following functions:

a. Select Plat(s)
b. Select Inspection Items
c. Select Plat Themes

In the initial execution of this function, display the plat(s) selected in 2.1, Select Plat(s), in a window. (Refer to Section 1.3(b).)

2.3 Display Associated Windows

In a separate text window, display the list of Inspection Items (IID's), with their MTRSQ locations, found in the plat(s) displayed. Whenever the plat view is adjusted, as described above, update this first text window. (Refer to Section 1.3(c).)

For each Inspection Item in this first text window, visually indicate whether it is selected for display. Selection and deselection of Inspection Items will subsequently occur in the Select Inspection Items function. (Refer to Section 1.3(d).)

In a second text window, display the current year inspection priorities, and date of last inspection (inspection history close date) for each of the currently selected IID's in the first text window. (Refer to Section 1.3(g).)

In a third text window, display the current inspection history records for each of the currently selected IID's in the first text window. Whenever the view is adjusted, as described above, update this third text window. (Refer to Section 1.3(h).)

In a fourth text window, display the well/completion records and the facility records for each of the IID's selected for inspection in the first text window. If there are too many individual wells or facilities to be inspected in one day (subjective judgement), reduce the number of IID's to be inspected by deselecting one or more of the IID's in the first text window. Whenever the view is adjusted, as described above, update this fourth text window. (Refer to Section 1.3(i).)

In a fifth text window display the list of Plat themes which apply to any LLD in the plat(s) displayed. Whenever the view is adjusted, as described above, update this fifth text window. (Refer to Section 1.3(j).)

For each window, visually indicate whether each of it's respective contents has been selected for display. Selection and deselection of Plat themes will subsequently occur in the Select Plat Themes function. (Refer to Section 1.3(d).)

2.4 Select Inspection Items

The user may select or deselect Inspection Items in the first text window. If the user selects an Inspection Item for display, indicate that it is now selected. If the user deselects an Inspection Item, similarly indicate that it is deselected. As Inspection Items are selected or deselected, update the plat window by adding or removing the corresponding visual overlays. This display will consist of shading the MTRSQ location, down to quarter-quarter section, and labeling it with the IID number on the selected MTR plat for all IID's currently selected in the first text window. (Refer to Sections 1.3(d), 1.3(k).)

2.5 Select Plat Themes

The user may select or deselect Plat Themes from the fifth text window. If the user selects a Plat Theme for display, indicate that it is now selected. If the user deselects a Plat Theme, similarly indicate that it is deselected. As Plat Themes are selected or deselected, update the plat window by adding or removing the corresponding visual overlays. Plat themes include the transportation network, hydrography, and geo-political boundaries. (Refer to Section 1.3(f).)

2.6 Display Inspection Priority, History, and Well/Facility Information

In a second text window, display the current year inspection priorities, and date of last inspection (inspection history close date) for each of the currently selected IID's in the first text window. In a third text window, display the current inspection history records for each of the currently selected IID's in the first text window. In a fourth text window, display the well/completion records and the facility records for the Inspection Items selected in the first text window. The will be no selection from these windows. They only display additional information about Inspection Items selected from the first text window. The second window displaying priority information, the third window displaying inspection history information, and the fourth window displaying well/facility information are optionally displayed by toggling a display selector for each extra window in the first text window where the Inspection Items are chosen. (Refer to Sections 1.3(g), 1.3(h), 1.3(i), 1.3(j).)

2.7 Display Visual Overlays

On the plat(s) displayed in the plat window, display the visual overlays corresponding to the Inspection Items and the Plat Themes selected for display. For example, overlay the selected plat with the transportation theme (roads).

The visual overlays for Inspection Items and the Plat Themes may be displayed via shading or coloration of areas on plats, via superimposition of characters or representative icons on plats, or via other user interface method selected by the Offeror. The selection and implementation of the Re-engineered Software user interface is an opportunity for the Offeror to demonstrate skill in the development and integration of software which presents geographic information in a clear and understandable way. (Refer to Sections 1.3(e), 1.3(f).)

2.8 Adjust View

The user may select a subset of the area displayed in the plat window for zooming in. Upon this indication by the user, display the smaller area of the plat(s) in a more detailed fashion in the plat window.

As an alternate action, the user may indicate that the display is to zoom out to one of the larger and less detailed views previously displayed. Upon this indication by the user, zoom out to the previous view. Allow zoom range to extend from the initial display of the entire Inspection Item location to the most detailed display yet made.

While the display is zoomed in to higher detail than that of the initial display, the user may indicate that the display is to be panned horizontally or vertically. Smoothly pan the display, within the plat(s) originally selected.

In conjunction with any of the adjustments of the display described above, update the other text windows, which are described above.

All text windows and the plat graphic window will display data only for the currently selected IID's. If, at any time, a IID is deselected from the list of available IID's in the first text window, all other windows will be updated to reflect only the IID's still selected. (Refer to Section 1.3(l).)

2.9 Print Window

The user may indicate that any window is to be output on any hardcopy output device connected to any node on the LAN or WAN. Prompt the user to specify which type of proposed output device is to be used (e.g., line printer, page printer, plotter, color graphics hardcopy device, film recorder) and at which physical location the printing is to be performed (e.g., at the terminal or workstation, at a workstation on the LAN or WAN, at a multi-user processor on the LAN or WAN).

Print the contents of the selected window on the specified output device at the specified location. If the plat window is selected, include in the printed version the overlays representing the same Inspection Items and Plat Themes as are selected for display.

Display/Print the selected plat showing the MTRSQ's with IID's selected for inspection and the existing access roads. (Refer to Section 1.3(m).)

2.10 Input New Inspection Report and Incidents of Noncompliance (INC) Records

Input new inspection report for existing IID's inspected. Input minor INC for one of the existing IID's inspected (refer to Section 1.3(o)). Entering a new report involves updating the header, priority, facility, and well records based on annotations made by the inspector on the inspection report, using the update features of AIRS. New inspection history information from the blank inspection section of the inspection report are added using the add feature of AIRS. The current AIRS Handbook instructions for entering a new report and entering an Incident of Noncompliance are contained in Exhibit A-1, Section 3.3, "Entering a New Report," starting on page EX-A-1-3, and Exhibit A-1, Section 3.7, "Entering an INC," starting on page EX-A-1-39, respectively. An example of Form 3160-9, Notice of Incidents of Noncompliance is found in Exhibit A-1, on page EX-A-3-1. The data elements mentioned in this Section are listed in the data dictionary found in the text file named AIRSDED. All actions described in these Sections are to be re-engineered for this demonstration.

2.11 Print Formatted Reports

Display and print an Inspection Report for each IID selected for inspection. Print new inspection report reflecting updated inspection history and outstanding INC's. (Refer to Sections 1.3(n), 1.3(p).) Exhibit A-1 represents a subset/excerpt of a handbook developed by BLM for the entire AIRS application. For the purposes of this ODP portions of the handbook are included to document requirements which Offerors will need to develop the components discussed herein. The data elements mentioned in this section are listed in the data dictionary found in the text file named AIRSDED. The Inspection Report is the only existing report from the total AIRS Handbook to be demonstrated.

2.12 Save Inspection Item Selections

The user may indicate that the work in progress in selecting Inspection Items for inspection is to be saved for later retrieval. Save the information entered during this session and the selections made for later retrieval by Inspection Item Number (IID's).

3.0 EXHIBITS

The exhibits associated with this Appendix are found in Exhibit A.

APPENDIX B: PROCESSING LOAD FOR RE-ENGINEERED SOFTWARE TESTING

1.0 OVERVIEW

During the Re-engineered Software Test (Reference 2.3.3) various commands will be issued by the Government provided Remote Terminal Emulator to the multi-user computer system that is used in the Re-engineered Software Test configuration. The Remote Terminal Emulator commands will be run in parallel with the activities performed by the Re-engineered Software Test.

2.0 TASK LOAD ORGANIZATION

The task load will be organized as follows:

The number of ports used for this activity will be based on the multi-user system used during the Re-engineered Software Test.

Multi-user Class	Number of Ports
A	32
B	16
C	8
D	4
E	2

For each port to be used a "wk" user-id shall be created (wk0001..wk0032). Each port shall be configured at 9600 baud.

3.0 CREATION OF WORK FILES

Each user-id shall have a separate home directory (e.g., /usr/wk0000... /usr/wk0032).

Before the start of the Re-engineered Software Test, Government representatives will run a series of utility programs that will create thirteen (13) 500,000 byte work files in the wk0000 user-id's home directory. The work files will be named "work01...work13". Each work file will consist of approximately 5,000 lines of ascii text. The first 4,900 lines of text in each file will be identical. There may be variable data in the last 100 lines.

During the Re-engineered Software Test the Government supplied Remote Terminal Emulator will issue commands of the following types:

```
(export X; X=$$; cp ../wk0000/work01 work01$X; cp
            ../wk0000/work02 work02$X; diff work01$X work02$X; rm
            -rf work01$X* work02$X*) &

(export X; X=$$; cp ../wk0000/work03 work03$X; wc work03$X; rm -
            rf work work03$X*) &

(export X; X=$$; cp ../wk0000/work04 work04$X; pack work 04$X; rm
            -rf work04$X*) &

(export X; X=$$; cp ../wk0000/work05.z work05$X.z; unpack
            work05$X.z; rm -rf work05$X*) &

(export X; X=$$; cp ../wk0000/work06 work 06$X; split -2000
            work06$X work06$X; rm work06$X*) &

(export X; X=$$; cp ../wk0000/work07 work07$X; csplit -f work07$X
            work07$X /party/ {4}; rm -rf work07$X*) &

(export X; X=$$; cp ../wk0000/work08 work08$X; od -c work08$X |
            tail; rm -rf work 08$X*) &

(export X; X=$$; cp ../wk0000/work09 work09$X; dd lf = work09$X
            conv = case | sum; rm -rf work09$X*) &

(export X; X=$$; cp ../wk0000/work10 work10$X; cp
            ../wk0000/work11 work11$X; comm -3 work10$X work11$X
            | wc; rm -rf work10$X* work11$X*) &

export X; X=$$; cp ../wk0000/work12 work12$X; cp ../wk0000/work13
            work13$X; cmp work12$X owrk13$X; rm -rf work12$X*
            work12$X*)
```

A command run in the background will be issued approximately every 30 seconds.

The RTE will not wait for the completion of a command before a new command is issued.

The issuance of each command might be varied. For example: each user-id might not issue it's commands in the same sequence as another user-id.

The names of the disk files used by the commands shall change each time a command is issued, so that all of the files in a user-id directory are accessed during the test.

APPENDIX C: FUNCTIONAL DEMONSTRATIONS

1.0 INTRODUCTION

1.1 Purpose

This document contains the specifications of the Functional Demonstrations (FD) included in the Offeror Demonstrations required in response to RFP # N-652-RFP1-0002. The Offeror Demonstrations are described in the Offeror Demonstration Package, of which this document is Appendix C.

1.2 Overview

Functional Demonstrations are demonstrations of a subset of the capabilities of the solution proposed by each Offeror in response to the RFP. All Offerors must perform all the Functional Demonstrations described herein. The FDs will be performed during the Unwitnessed Demonstrations Phase II as well as the Witnessed Demonstrations component of the Offeror Demonstrations, concurrent with various other Witnessed Demonstration activities, such as Software Re-engineering Activities, Operational Capability Demonstrations, and Management Reviews.

All the FDs are to be performed only using the standard distributed file system supplied with the operating system.

All printouts, screen-dumps, tapes, other removable media, etc., created during the FDs shall be supplied to the Government as part of the Offeror Demonstrations.

1.3 Interaction with Re-engineering Activities

Some of the FDs described below involve actions performed from within the Re-engineering Activities which is also being demonstrated during the Witnessed Demonstrations component of the Offeror Demonstrations. These FDs stand alone in their demonstrations of particular capabilities of the proposed solution, but their invocation is to be as options available to the user of the Re-engineering Activities. The FDs are not part of the Re-engineering Activities per se. However, where indicated, they are to be executed from the same screen or menu as are the functions of the Re-engineering Activities.

If no mention of the Re-engineering Activities is made in the description of an FD, it may be invoked from within the Re-engineering Activities or in any other fashion chosen by the Offeror.

1.4 Demonstration Environment

The Functional Demonstrations shall be executed using proposed hardware, software, and communications equipment. The Contract Line Item Number (CLIN) of each component shall be identified (refer to RFP Sections B.2 and B.6.) All console logs, system generation reports, and other materials documenting the environment and execution of the FDs shall be provided to the Government.

2.0 FUNCTIONAL DEMONSTRATIONS

The individual Functional Demonstrations specifications occur in sections 2.1 through 2.35 (refer to Exhibits C-1 through C-4.)

2.1 FD 1 - DISTRIBUTED FILE SYSTEM CAPABILITIES

2.1.1 Objective

Demonstrate the Distributed File System (DFS) capabilities of the proposed operating system, using magnetic and optical media accessed locally and remotely by workstations and X-Terminals. Demonstrate the performance characteristics of each type of access.

2.1.2 RFP References

C.2.2.1
C.3.3

2.1.3 Instructions

In this FD, the Offeror will access files using the Distributed File System in order to demonstrate its transparent support for various types of media accessed locally and across a LAN and the WAN. For all file accesses, the Offeror will retain and provide performance metrics which illustrate the difference in performance between local file access and remote file access.

The input data file specified in the Data section below is to be used to create an indexed sequential file. The Offeror will create exactly one record in the indexed file for each record in the input file. The only index on the file is to be on the field Index1. The records in the indexed file shall physically be in the same order as the index.

In order to minimize overhead not directly associated with the file system, the Offeror will create programs which invoke file system functions in the fashion which least involves non-file system processing, e.g., language interpreter overhead, etc. These file system invocations may be in any proposed language, as long as the same standard file system is accessed as that which is normally accessed by the proposed higher order languages, and as long as it is accessed in the same manner (i.e., via the same calls, macros, etc.).

Each read or write operation shall access the entire record being processed. For read operations, the entire record shall be read into memory. For read and rewrite operations, the entire record shall be read into memory from the storage device involved and written from memory to the storage device. No disk caching shall be performed whatsoever except for single record buffering.

The Offeror will collect and present the following performance metrics for each file access, in accordance with the instructions given in the script:

a. Time elapsed from issuance of file access command by workstation or X-Terminal to completion of file access from the point of view of the workstation or X-Terminal.

b. Host CPU time dedicated to processing the I/O request. If more than one CPU is involved, time for each shall be separately retained and reported.

c. Number of input/output instructions at the device level. If more than one device is involved, I/O instructions for each shall be separately retained and reported.

d. Number of page faults.

The Offeror will also collect and present the elapsed time for each step in the Script for Workstation and Script for X-Terminal sections below.

Processing Environment

The following hardware shall be used for this FD:

MPB-A	Multi-user Processor Class B on LAN A
MPD-B	Multi-user Processor Class D on LAN B
WP-A	Personal Workstation on LAN A
WA-C	Advanced Workstation on LAN C
WB-A	Basic Workstation on LAN A
WD-A	Administrative Workstation on LAN A
XT-A	X-Terminal on LAN A

2.1.3.1 Script

2.1.3.1.1 Script for Setup

The following steps shall be performed initially:

a. Use the input data file specified in the Data section below to create file MagWP-A residing on a magnetic disk attached to WP-A.

b. Copy the file MagWP-A to create file OptWP-A residing on an optical disk attached to WP-A.

c. Copy the file MagWP-A to create file MagWB-A residing on a magnetic disk attached to WB-A.

d. Copy the file MagWP-A to create file MagMPB-A residing on a magnetic disk attached to MPB-A.

e. Copy the file MagWP-A to create file OptMPB-A residing on an optical disk attached MPB-A.

f. Copy the file MagWP-A to create file MagMPD-B residing on a magnetic disk attached to MPD-B.

g. Copy the file MagWP-A to create file OptMPD-B residing on an optical disk attached to MPD-B.

h. Save a copy of the file MagWP-A on tape.

2.1.3.1.2 Script for Advanced Workstation

The following set of steps shall be performed in its entirety from WP-A:

a. Perform 1000 sequential DFS file read operations upon MagWP-A. While reading MagWP-A, create a table in memory which contains the index values corresponding to the order of the Order1 field. (This table is to be used later for ordering the random accesses to the various files.)

b. Perform the same 1000 sequential DFS file read operations upon OptWP-A. (The table need not be created again here or in subsequent steps).

c. Perform the same 1000 sequential DFS file read operations upon MagWB-A.

d. Perform the same 1000 sequential DFS file read operations upon MagMPB-A.

e. Perform the same 1000 sequential DFS file read operations upon OptMPB-A.

f. Perform the same 1000 sequential DFS file read operations upon MagMPD-B.

g. Perform the same 1000 sequential DFS file read operations upon OptMPD-B.

h. Perform 1000 random DFS file read and rewrite operations upon MagWS, accessed in the order of the Order1 field (which is not indexed), replacing the contents of the field Field1 with the sequence number of the rewrite operation. (Index values corresponding to the order of the Order1 field were saved in memory in an earlier step.)

i. Perform the same 1000 random DFS file read and rewrite operations upon OptWS, accessed in the order of the Order1 field (which is not indexed), replacing the contents of the field Field1 with the sequence number of the rewrite operation.

j. Perform the same 1000 random DFS file read and rewrite operations upon MagWB-A, accessed in the order of the Order1 field (which is not indexed), replacing the contents of the field Field1 with the sequence number of the rewrite operation.

k. Perform the same 1000 random DFS file read and rewrite operations upon MagMPB-A, accessed in the order of the Order1 field (which is not indexed), replacing the contents of the field Field1 with the sequence number of the rewrite operation.

l. Perform the same 1000 random DFS file read and rewrite operations upon OptMPB-A, accessed in the order of the Order1 field (which is not indexed), replacing the contents of the field Field1 with the sequence number of the rewrite operation.

m. Perform the same 1000 random DFS file read and rewrite operations upon MagMPD-B, accessed in the order of the Order1 field (which is not indexed), replacing the contents of the field Field1 with the sequence number of the rewrite operation.

n. Perform the same 1000 random DFS file read and rewrite operations upon OptMPD-B, accessed in the order of the Order1 field (which is not indexed), replacing the contents of the field Field1 with the sequence number of the rewrite operation.

o. Save copies of the modified files to a 9 track tape drive on MPB-A.

p. Print the elapsed time of each step above

2.1.3.1.3 Script for Basic Workstation

Execute the same steps executed in section 2.1.3.1.2, but execute them from WB-A instead of WP-A.

2.1.3.1.4 Script for Remote Advanced Workstation

Execute the same steps executed in section 2.1.3.1.2, but execute them from WA-C instead of WP-A.

2.1.3.1.5 Script for Administrative Workstation

Execute the same steps executed in Section 2.1.3.1.2, but execute them from WD-A instead of WP-A.

2.1.3.1.6 Script for X-Terminal

Execute the same steps executed in section 2.1.3.1.2, but execute them from XT-A instead of WP-A.

2.1.3.2 Data

The input data file FD1INPUT for this FD is supplied in Appendix D, Government Supplied Data. It is a fielded, sequential ASCII file which includes the numeric integer field Field1 and the numeric field Order1 (and other fields).

The output file consisting of performance metrics shall be a sequential ASCII file, with the record layout below. Each numeric field (identified by an N in the A/N column below) shall be right-justified and left-zero-filled. Each alphanumeric field (identified by an A in the A/N column below) shall be left justified.

Start	End	Field Name	A/N	Description
1	8	OrigID	A	Originating Workstation/XTerm ID
9	16	FileID	A	ID of File Being Accessed
17	18	IOType	A	Type of I/O Access[1]
19	23	SeqNr	N	Sequence Number of I/O[2]
24	26	ElapseSSS	N	Elapsed Time: Seconds
27	30	ElapseTTTT	N	Elapsed Time: Tenthousandths
31	33	TotCPUSec	N	Total CPU Time: Seconds
34	37	TotCPUTT	N	TotalCPU Time: Tenthousandths
38	40	CPUSec1	N	1st CPU Time: Seconds
41	44	CPUTT1	N	1st CPU Time: Tenthousandths
45	47	CPUSec2	N	2nd CPU Time: Seconds
48	51	CPUTT2	N	2nd CPU Time: Tenthousandths
52	56	TotDIO	N	Tot Dir I/O Count for All Devices
57	60	DIO1	N	Direct I/O Count for First Device
61	64	DIO2	N	Direct I/O Count for Second Dev[3]
65	68	DIO3	N	Direct I/O Count for Third Dev[3]
69	72	DIO4	N	Direct I/O Count for Fourth Dev[3]
73	77	TotBIO	N	Tot Buff I/O Count for All Dev
78	81	BIO1	N	Buff I/O Count for First Device
82	85	BIO2	N	Buff I/O Count for Sec. Device[4]
86	89	BIO3	N	Buff I/O Count for Third Device[3]
90	93	BIO4	N	Buff I/O Count for Fourth Device[3]
94	100	PgFaults	N	Number of Page Faults

2.1.3.3 Reserved

2.1.4 Expected Output

The output from the FD shall include a printed report containing summary totals of the performance metrics specified above, by Originating Workstation and File ID. It shall have the following format:

Originating Workstation	I.O. File ID	Type	Average Elapsed Time	Avg.Tot. CPU Time	Avg Total I/O Count
XXXXXXXX	XXXXXXXX	XX	999.9999	999.9999	999

---

[1] "SR" if sequential read, "RW" if random read and rewrite

[2] SeqNr is the Sequence number of the I/O within the group of I/Os from this originating workstation or X-Terminal to this file.

[3] For use only if necessary.

[4] For use only if necessary.

The output from the FD shall include a file containing performance metrics as described in the Data section above.

The output of the FD shall include a tape copy of the unmodified file MagWP-A and tape copies of each of the files modified in the FD on a 9 track 6250 bpi tape.

2.1.5 Reserved

2.2 RESERVED

2.3 FD 3 - RDBMS DISTRIBUTION

2.3.1 Objective

Demonstrate the distributed nature of the relational data base management system proposed and its recovery and synchronization capabilities.

2.3.2 RFP References

C.2.2.1
C.4.4
C.4.4.5
C.4.4.6
C.4.4.8

2.3.3 Instructions

In this FD, all backup and recovery functions shall be performed using only the standard distributed file system proposed as an integral part of the operating system proposed. No direct access to storage devices shall be performed outside of the operations of the standard distributed file system.

Within the programs provided, some statements are in parentheses. These statements are not in any programming language and may be programmed in any proposed language as necessary to achieve the processing indicated by the statement. Statements not in parentheses are in SQL and must be executed exactly as written, with no modification whatsoever.

Processing Environment

The following hardware shall be used for this FD:

MPA-A	Multi-user Processor Class A on LAN A
MPD-B	Multi-user Processor Class D on LAN B
PSW-B	Serial Printer Wide on LAN B
WA-A	Advanced Workstation on LAN A
WP-A	Personal Workstation on LAN A
WB-C	Basic Workstation on LAN C
WD-A	Administrative Workstation on LAN A
XT-A	X-Terminal on LAN A

In the scripts below, any proposed printer and tape drive may be used. Each may be connected to either MPA-A or MPD-B.

2.3.3.1 Script

The following scripts shall be executed sequentially. Within each script, the steps shall be executed sequentially.

2.3.3.1.1 Script for Setup

a. Load the input file DRFile1 into RDBMS table MPA-AMag in such a fashion as to cause it to reside physically upon a magnetic disk attached to MPA-A.

b. Load the input file DRFile2 into RDBMS table MPD-BMag in such a fashion as to cause it to reside physically upon a magnetic disk MPD-BMagDisk attached to MPD-B.

c. Load the input file DRFile3 into RDBMS table MPA-AOpt in such a fashion as to cause it to reside physically upon an optical disk attached to MPA-A.

d. Load the input file DRFile4 into RDBMS table MPD-BOpt in such a fashion as to cause it to reside physically upon an optical disk attached to MPD-B.

e. Load the input file DRFile5 into RDBMS table WA-AMag in such a fashion as to cause it to reside physically upon a magnetic disk attached to workstation WA-A.

f. Print the contents of the tables MPA-AMag, MPA-AOpt, MPD-BMag, MPD-BOpt, and WA-AMag and save copies of them to tape.

g. Print the logical and physical schemas of the data base consisting of the tables MPA-AMag, MPA-AOpt, MPD-BMag, MPD-BOpt, and WA-AMag.

2.3.3.1.2 Script for Initial Execution

a. From WA-A execute program Program1, directing its output both to the workstation screen and to a printer.

b. Print the contents of the tables MPA-AMag, MPA-AOpt, MPD-BMag, MPD-BOpt, and WA-AMag and save copies of them to tape.

c. From WP-A execute program Program1, directing its output both to the workstation screen and to a printer.

d. Print the contents of the tables MPA-AMag, MPA-AOpt, MPD-BMag, MPD-BOpt, and WA-AMag and save copies of them to tape.

e. From WD-A, execute program Program1, directing its output both to the workstation screen and to a printer.

f. Print the contents of the tables MPA-AMag, MPA-AOpt, MPD-BMag, MPD-BOpt, and WA-AMag and save copies of them to tape.

g. From WB-C execute program Program1, directing its output both to the workstation screen and to a printer.

h. Print the contents of the tables MPA-AMag, MPA-AOpt, MPD-BMag, MPD-BOpt, and WA-AMag and save copies of them to tape.

2.3.3.1.3 Script for Abnormal Interruption and Subsequent Restoration

a. From WA-A, execute program Program2.

b. During execution of Program2, at the time it displays the message "Interrupt Processing Now!", impose an abnormal interruption of processing upon MPD-B and MPD-BMagDisk.

c. Restart MPD-B without MPD-BMagDisk. Restore the data base to the last committed and synchronized state prior to the abnormal interruption of processing, i.e., to the state in which it was just after the last execution of a COMMIT statement before the interruption of processing. The table MPD-BMag is to be restored to a magnetic disk other than MPD-BMagDisk connected to MPD-B. Synchronization is to include synchronization of any RDBMS data bases or components on MPA-A, MPD-B, and the workstation.

d. Print the contents of the table MPD-BMag to demonstrate that the transaction pending at the time of the interruption of processing was properly rolled back.

e. Print the logical and physical schemas of the data base consisting of the tables MPA-AMag, MPA-AOpt, MPD-BMag, MPD-BOpt, and WA-AMag.

2.3.3.1.4 Script for Reconfiguration

a. Use the RDBMS administration facilities to reconfigure the data base containing MPA-AMag such that MPA-AMag is defined as residing only on an optical disk on MPD-B. (Do not change its name.)

b. Physically move MPA-AMag to the optical disk on MPD-B.

c. Print the logical and physical schemas of the data base consisting of the tables MPA-AMag, MPA-AOpt, MPD-BMag, MPD-BOpt, and WA-AMag.

2.3.3.1.5 Script for Execution on Reconfigured System

a. From an X-Terminal connected to MPA-A, execute program Program1, directing its output both to the X-Terminal screen and to a printer.

b. Print the contents of the tables MPA-AMag, MPA-AOpt, MPD-BMag, MPD-BOpt, and WA-AMag and save copies of them to tape.

2.3.3.2 Data

The input data files, DRFile1, DRFile2, DRFile3, DRFile4, and DRFile5, for this FD are supplied in Appendix D, Government Supplied Data.

2.3.3.3 Programs

The program Program1 performs selections, projections, and a join of the tables MPA-AMag, MPA-AOpt, MPD-BMag, MPD-BOpt, and WA-AMag, and an update of the table MPD-BMag, updating it with a time stamp which indicates when the update operation was performed, but otherwise leaving it in the same condition it was in before execution. Thus Program1 can be used repeatedly, with the only difference in result being the assignment of different time stamps.

```
Program Program1

(Set the value of <TimeStamp> to the current time in
minutes and seconds to the nearest thousandth of a
second)
SELECT  MPA-AMagField1,MPD-BMagField1,
        MPA-AOptField1,MPD-BOptField1
FROM    MPA-AMag, MPD-BMag, MPA-AOpt, MPD-BOpt
WHERE   MPA-AMagJoin = MPD-BMagJoin
AND MPD-BMagJoin = MPA-AOptJoin
AND MPA-AOptJoin = MPD-BOptJoin
AND MPD-BOptJoin = WA-AMagJoin
AND MPA-AMagJoin = 1
AND MPA-AMagField1 = 1
AND MPD-BMagField1 = 1
AND MPA-AOptField1 = 1
AND MPD-BOptField1 = 1
AND WA-AMagField1 = 1

UPDATE  TABLE MPD-BMag
SET MPD-BMagField2 = <TimeStamp>
WHERE   MPD-BMagField1 = 2
```

The program Program2 performs update of the table MPD-BMag, updating it with a time stamp which indicates when each update operation was performed. Update operations are grouped as transactions. One transaction is started, performed, and committed. The other transaction is begun partially performed, but not committed before the printing of a message "Interrupt Processing Now!" and a pause. If processing is interrupted during the pause, one update operation will not have been committed. Subsequent restart and recovery will test the recovery and rollback capabilities of the proposed system. The program is as follows:

```
Program Program2

(Set the value of <TimeStamp> to the current time in
minutes and seconds to the nearest thousandth of a
second)

(Begin a logical transaction)

UPDATE  TABLE MPD-BMag
SET MPD-BMagField2 = <TimeStamp>
WHERE   MPD-BMagField1 = 3
```

(Set the value of <TimeStamp> to the current time to the nearest thousandth of a second)

```
UPDATE  TABLE MPD-BMag
SET MPD-BMagFiela2 = <TimeStamp>
WHERE   MPD-BMagField1 = 4
```

(Commit the transaction.)

(Begin a logical transaction)

```
UPDATE  TABLE MPD-BMag
SET MPD-BMagField2 = <TimeStamp>
WHERE   MPD-BMagField1 = 5
```

(Display the message "Interrupt Processing Now!".)

(Initiate a pause or enter an endless loop, waiting for interruption of processing.)

(Set the value of <TimeStamp> to the current time in minutes and seconds to the nearest thousandth of a second)

```
UPDATE  TABLE MPD-BMag
SET MPD-BMagField2 = <TimeStamp>
WHERE   MPD-BMagField1 = 6
```

(Commit the transaction.)

2.3.4 **Expected Output**

The output from the FD shall include the screen display and printed output of each execution of program Program1 and the execution of Program2.

The output from the FD shall include the printed copies of the tables involved, and the tape copies of them, taken at the points identified in the script.

The output from the FD shall include the logical and physical schemas of the data bases involved, printed at the points indicated in the script.

2.3.5 **Reserved**

2.4 FD 4 - OFFICE AUTOMATION

2.4.1 Objective

Demonstrate various integrated office automation capabilities of the proposed solution. Demonstrate functionality and the ability to transfer data of RDBMS, spreadsheet, word processing, statistical analysis, desktop publishing, and electronic mail packages.

2.4.2 RFP References

C.4.9
C.4.9.2.5
C.4.9.3.2
C.4.9.3.3
C.4.9.3.5
C.4.9.4.1
C.4.9.6
C.4.9.7
C.4.9.8.2
C.4.9.8.4
C.4.10

2.4.3 Instructions

Processing Environment

The following hardware shall be used for this FD:

PPL-B	Page Printer Low-Range on LAN B
PPM-A	Page Printer Mid-Range on LAN A
SD-A	Document Scanner on LAN A
WP-A	Personal Workstation on LAN A
WD-A	Administrative Workstation on LAN A
WPT-B	Portable Workstation on LAN B

The data files and DBMS table necessary to perform the demonstration, described in the Data section below, shall reside on WP-A.

The Offeror will use the proposed DBMS to create a database for this demonstration. The database shall include the table OATEST. This table should have four floating-point columns.

Only the proposed office automation software packages, the proposed DBMS, and the proposed operating system and associated utilities shall be used to perform the FD. The Offeror may not write or use any software not elsewhere proposed to perform this FD.

The Offeror will document the commands required to perform each of the steps outlined in the script below. The commands should demonstrate the consistency of commands among the office automation applications and the graphical user interface (GUI).

2.4.3.1 Script

2.4.3.1.1 Steps to be performed on workstation WP-A

a. Create the table OATEST in the database from the data in the ASCII file OATEST.ASC specified in the Data section below. Use the ASCII load utility supplied with the proposed database.

b. Load the worksheet file OATEST.WKS described in the Data section below into the spreadsheet package.

c. With the RDBMS, access the database that contains the table OATEST, described in the Data section below. Copy the first three columns of each row in the table to columns A-C in the spreadsheet, starting with row 3.

d. Copy the formula in cell D2 of the spreadsheet to column D for each of the rows of data taken from the database, and recalculate the spreadsheet.

e. Update the fourth column in the RDBMS table OATEST with the new values calculated by the spreadsheet for column D.

f. Import the data from the RDBMS into the statistical analysis package.

g. Consider the first column of the data the independent value and the fourth column the dependent value. Produce a scatter plot. Find and plot on the same graph the least-variance straight line through the points of the scatter plot.

h. Load the document in the ASCII file OATEST.DOC specified in the Data section below into the word processor. Import the graph from the statistical analysis package and the spreadsheet into the document. Change the wording of the document.

i. Import the resulting document into the desktop publishing package. Arrange the text of the document in two columns on the page. Arrange the spreadsheet and graph so that they appear at the bottom of the page, taking the full width of the page, with the graph before the spreadsheet.

j. Print the document on PPM-A and on PPL-B.

k. Send a copy of the document via electronic mail to user USR2, on a processor, WD-A, connected to WP-A only via the proposed LAN.

l. Send a copy of the document via electronic mail to user USR3, on a processor, WPT-B, connected to WP-A via the proposed WAN.

2.4.3.1.2 Steps to be performed on workstation WD-A

a. Log in to WD-A as USR2.

b. Receive the transmitted document from the message system.

c. Display the document.

d. Print the document on PPM-A.

e. Scan the document on SD-A.

f. Display the scanned document on WD-A.

g. Print the scanned document on PPM-A.

2.4.3.1.3 Steps to be performed on workstation WPT-B

a. Log in to WPT-B as USR3.

b. Receive the transmitted document from the message system.

c. Display the document.

d. Print the document.

2.4.3.2 Data

The worksheet file to be used in this FD is the Lotus format file OATEST.WKS in Appendix D.

2.4.3.2.1 Document

In creating the document in the word processor, the Offeror should first import the standard ASCII text file OATEST.DOC. The contents of this file are given here (but are, in fact, arbitrary):

SYSTEMATIC ERRORS IN OBSERVATIONS

Due to the properties of the experimental apparatus, systematic errors are introduced into the observations. These errors become larger with each trial unless the apparatus is reset.

Careful recalibration of the apparatus has allowed us to derive empirically a correction formula. When this formula is applied to the result, the systematic errors are eliminated.

Here, you see the result of applying the formula to a specific sequence of observations.

(Enter spreadsheet here)

Note that when the result is plotted, it exhibits the expected behavior.

(Enter graph here.)

2.4.3.3 Reserved

2.4.4 Expected Output

The output from the FD shall include hardcopy of the printed document in the script.

2.4.5 Reserved

2.5 RESERVED

2.6 RESERVED

2.7 FD 7 - SECURITY

2.7.1 Objective

Demonstrate the security facilities of the proposed operating system and/or access control package. Demonstrate that the access control package can limit access to named information resources (programs, data files, directories) on a per-user basis. Demonstrate that access control can be maintained transparently over a LAN or WAN. Show that the access control lists prevent unauthorized access. Show that the access control lists can control individually read and modify access to directories; read, modify and delete access to data files; read, modify, delete and execute access to programs. Demonstrate operating system's ability to restrict access to the system to authorized users, and to authenticate users' identity with passwords. Show that operating system keeps audit trail of security related activities.

2.7.2 RFP References

C.4.5
C.18.1
C.18.2.1
C.18.2.2
C.18.2.3
C.18.2.4

2.7.3 Instructions

This demonstration will require three participants. One must be logged in as a security administrator on a workstation from which security operations are permitted. Another, User1, shall perform the various authorized and unauthorized actions outlined in the scripts below, using various workstations and an X-Terminal, accessing various multi-user processors. The third, User2, shall attempt unauthorized access to User1's files.

The security administrator will grant successively more extensive privileges to User1. At each step, it shall be verified that User1's access privileges are the same whether User1 is accessing the information resources locally, across the LAN, or across the WAN.

Processing Environment

The following hardware shall be used for this FD:

MPB-A	Multi-user Processor Class B on LAN A
MPD-B	Multi-user Processor Class D on LAN B
MPE-A	Multi-user Processor Class E on LAN A
PSN-A	Serial Printer Narrow on LAN A
WA-A	Advanced Workstation on LAN A
WB-A	Basic Workstation on LAN A
WP-B	Personal Workstation on LAN B
XT-A	X-Terminal on LAN A

2.7.3.1 Script

2.7.3.1.1 Script for Multi-user Processor Access via Workstation

Perform the following steps with the security administrator using WA-A to log on to MPB-A, User1 using WB-A to log on to MPB-A, and User2 using XT_A to log on to MPB-A.

a. As security administrator, use WA-A to log on to MPB-A.

b. As security administrator, revoke the User1's account on MPB-A.

c. As security administrator, set the access control mechanism to disable a terminal or workstation after six unsuccessful attempts to log on.

d. As the User1, attempt to log on to the system at least six times. After the sixth unsuccessful attempt, the terminal or workstation shall be disabled by the access control mechanism.

e. As security administrator, re-enable the terminal or workstation, and re- establish the logon id of User1. The access control mechanism shall generates a password for User1.

f. As User1, log on to the system.

g. As security administrator, create a directory Dir1 in a portion of the distributed file system on the multi-user processor to which User1 is logged on. Populate Dir1 with two Offeror-provided data files A and B and an Offeror-provided executable program C. Assign access control lists for all permissions regarding the directory and the files within it. Initially, none of the access control lists shall include User1.

h. As User1, verify inability to look at the contents of Dir1, or access in any way any of the files therein.

i. As security administrator, put User1 in Dir1's read access control list and in the read access control list of the data file B.

j. As User1, verify the ability to list the contents of Dir1, and the inability to access any of the files therein or create or delete any files in Dir1.

k. As security administrator, put User1 in Dir1's modify access control list; and in file C's execute access control list.

l. As User1, verify the ability to create and delete new files in Dir1, and read, but not update, data file B. Verify the inability to update data file A. Verify the ability to execute the executable file C.

m. As security administrator, put User1 in file B's modify access control list.

n. As User1, verify the ability to read and modify the file B.

o. As User1, create a new file D which User2 does not have permission to read and file E which User2 has access to read, but not access to modify.

p. As User1, log off MPB-A.

q. As User2, use XT-A to log on to MPB-A.

r. As User2, verify the inability to read file D and the ability to read file E but not update it.

s. As User2, log off MPB-A.

t. Copy the audit trail to a 9 track 6250 bpi tape, and generate a printed report from the audit trail. The audit trail shall reflect all the activities of security administrator, the unsuccessful and successful attempts of users to log in to the system, users' logging off the system, and the unauthorized attempts by User2 to read file D and modify file E.

2.7.3.1.2 Script for Multi-user Processor Access via X-Terminal

Perform the following steps with User1 using WB-A to log on to MPB-A and User1 using XT-A to log on to MPB-A.

a. As security administrator, use WA-A log on to MPB-A.
b. As security administrator, revoke User1's logon id and password on the system.

c. As security administrator, set the access control mechanism to disable a terminal or workstation after six unsuccessful attempts to log on.

d. As User1, attempt to log on to the system at least six times. After the sixth unsuccessful attempt, the terminal or workstation shall be disabled by the access control mechanism.

e. As security administrator, re-enable the terminal or workstation, and re- establish the logon id of User1. The access control mechanism shall generates a password for User1.

f. As User1, log on to the system.

g. As security administrator, create a directory Dir1 in a portion of the distributed file system on the multi-user processor to which User1 is logged on. Populate Dir1 with two Offeror-provided data files A and B and an Offeror-provided executable program C. Assign access control lists for all permissions regarding Dir1 and the files within it. Initially, none of the access control lists shall include User1.

h. As User1, verify inability to look at the contents of Dir1, or access in any way any of the files therein.

i. As security administrator, put User1 in Dir1's read access control list and in the read access control list of the data file B.

j. As User1, verify the ability to list the contents of Dir1, and the inability to access any of the files therein or create or delete any files in Dir1.

k. As security administrator, put User1 in Dir1's modify access control list; and in file C's execute access control list.

l. As User1, verify the ability to create and delete new files in Dir1, and read, but not update, data file B. Verify the inability to update data file A. Verify the ability to execute the executable file C.

m. As security administrator, put User1 in file B's modify access control list.

n. As User1, verify the ability to read and modify the file B.

o. As User1, log off the system.

p. Copy the audit trail to a 9 track 6250 bpi tape, and generate a printed report from the audit trail. The audit trail shall reflect all the activities of security administrator, the unsuccessful and successful attempts of User1 to log in to the system, and User1's logging off the system.

2.7.3.1.3 Script for LAN Access to Multi-user Processors

Perform the following steps with User1 using WB-A to log on to MPB-A and User1 using WB-A to log on to MPE-A.

a. As security administrator, use WA-A to log on to MPB-A.

b. As security administrator, revoke User1's logon id and password on MPE-A.

c. As security administrator, set the access control mechanism to disable a terminal or workstation after six unsuccessful attempts to log on.

d. As User1, attempt to log on to MPE-A at least six times. After the sixth unsuccessful attempt, the terminal or workstation shall be disabled by the access control mechanism.

e. As security administrator, re-enable the terminal or workstation, and re-establish the logon id of User1 on MPE-A. The access control mechanism shall generates a password for User1.

f. As User1, log on to MPE-A.

g. As security administrator, create a directory in a portion of the distributed file system on the MPE-A. Populate Dir1 with two Offeror-provided data files A and B and an Offeror-provided executable program C. Assign access control lists for all permissions regarding Dir1 and the files within it. Initially, none of the access control lists shall include User1.

h. As User1, verify inability to look at the contents of Dir1 on MPE-A, or access in any way any of the files therein.

i. As security administrator, put User1 in the MPE-A directory's read access control list and in the read access control list of the data file B on MPE-A.

j. As User1, verify the ability to list the contents of Dir1 on MPE-A, and the inability to access any of the files therein or create or delete any files in Dir1.

k. As security administrator, put User1 in the MPE-A directory's modify access control list; and the MPE-A file C's execute access control list.

l. As User1, verify the ability to create and delete new files in Dir1 on MPE-A, and read, but not update, data file B on MPE-A. Verify the inability to update data file A on MPE-A. Verify the ability to execute the executable file C on MPE-A.

m. As security administrator, put User1 in MPE-A file B's modify access control list.

n. As User1, verify the ability to read and modify the file B on MPE-A.

o. As User1, log off MPE-A.

p. As security administrator, create a directory Dir1 in a portion of the distributed file system on the MPB-A. Populate Dir1 with two

Offeror-provided data files A and B and an Offeror-provided executable program C. Assign access control lists for all permissions regarding Dir1 and the files within it. Initially, none of the access control lists shall include User1.

q. As User1, while still logged on to MPE-A, verify inability to look at the contents of Dir1 created on MPB-A, or access in any way any of the files therein.

r. As security administrator, put User1 in the MPB-A directory's read access control list and in the read access control list of the data file B on MPB-A.

s. As User1, verify the ability to list the contents of Dir1, and the inability to access any of the files therein or create or delete any files in Dir1.

t. As security administrator, put User1 in the MPB-A directory's modify access control list; and in MPB-A file C's execute access control list.

u. As User1, verify the ability to create and delete new files in the MPB-A directory, and read, but not update, data file B on MPB-A. Verify the inability to update data file A on MPB-A. Verify the ability to execute the executable file C on MPB-A.

v. As security administrator, put User1 in the MPB-A file B's modify access control list.

w. As User1, verify the ability to read and modify the file B on MPB-A.

x. As User1, create a new file D on MPB-A which User2 does not have permission to read and file E on MPB-A which User2 has access to read, but not access to modify.

y. As User1, log off MPE-A.

z. As User2, use XT-A to log on to MPD-B.

aa. As User2, verify the inability to read file D on MPB-A and the ability to read file E on MPB-A but not update it.

ab. As User2, log off MPD-B.

ac. Copy the audit trail to a 9 track 6250 bpi tape, and generate a printed report from the audit trail. The audit trail shall reflect all the activities of security administrator, the unsuccessful and successful attempts of users to log on to both MPE-A and MPB-A, users' logging off both MPE-A and MPB-A, and User2's attempts at unauthorized access to file D and file E on MPB-A.

2.7.3.1.4 Script for WAN Access to Multi-user Processors

Perform the following steps with User1 using MPT-B to log on to MPB-A and User1 using WP-B to log on to MPD-B.

a. As security administrator, use WA-A to log on to MPB-A.

b. As security administrator, revoke User1's logon id and password on MPD-B.

c. As security administrator, set the access control mechanism to disable a terminal or workstation after six unsuccessful attempts to log on.

d. As User1, attempt to log on to MPD-B at least six times. After the sixth unsuccessful attempt, the terminal or workstation shall be disabled by the access control mechanism.

e. As security administrator, re-enable the terminal or workstation, and re-establish the logon id of User1 on MPD-B. The access control mechanism shall generates a password for User1.

f. As User1, log on to MPD-B.

g. As security administrator, create a directory Dir1 in a portion of the distributed file system on the MPD-B. Populate Dir1 with two Offeror-provided data files A and B and an Offeror-provided executable program C. Assign access control lists for all permissions regarding Dir1 and the files within it. Initially, none of the access control lists shall include User1.

h. As User1, verify inability to look at the contents of Dir1, or access in any way any of the files therein.

i. As security administrator, put User1 in Dir1's read access control list and in the read access control list of the data file B on MPD-B.

j. As User1, verify the ability to list the contents of Dir1, and the inability to access any of the files therein or create or delete any files in Dir1.

k. As security administrator, put User1 in Dir1's modify access control list; and the file C's execute access control list.

l. As User1, verify the ability to create and delete new files in Dir1, and read, but not update, data file B on MPD-B. Verify the inability to update data file A on MPD-B. Verify the ability to execute the executable file C on MPD-B.

m. As security administrator, put User1 in MPD-B file B's modify access control list.

n. As User1, verify the ability to read and modify the file B on MPD-B.

o. As User1, log off MPD-B, then log back on.

p. As security administrator, create a directory Dir2 in a portion of the distributed file system on the MPB-A. Populate Dir2 with two Offeror-provided data files A and B and an Offeror-provided executable program C. Assign access control lists for all permissions regarding Dir2 and the files within it. Initially, none of the access control lists shall include User1.

q. As User1, while still logged on to MPD-B, verify inability to look at the contents of Dir2, or access in any way any of the files therein.

r. As security administrator, put User1 in the MPB-A directory's read access control list and in the read access control list of the data file B on MPB-A.

s. As User1, verify the ability to list the contents of Dir2, and the inability to access any of the files therein or create or delete any files in Dir2.

t. As security administrator, put User1 in Dir2's modify access control list; and in MPB-A file C's execute access control list.

u. As User1, verify the ability to create and delete new files in Dir2, and read, but not update, data file B on MPB-A. Verify the inability to update data file A on MPB-A. Verify the ability to execute the executable file C on MPB-A.

v. As security administrator, put User1 in the MPB-A file B's modify access control list.

w. As User1, verify the ability to read and modify the file B on MPB-A.

x. As User1, create a new file D on MPB-A which User2 does not have permission to read and file E on MPB-A which User2 has access to read, but not access to modify.

y. As User1, log off MPD-B.

z. As User2, use WP-B to log on to MPD-B.

aa. As User2, verify the inability to read file D on MPB-A and the ability to read file E on MPB-A but not update it.

ab. As User2, log off MPD-B.

ac. Copy the audit trail to a 9 track 6250 bpi tape, and generate a printed report from the audit trail. The audit trail shall reflect all the activities of security administrator, the unsuccessful and successful attempts of users to log on to MPD-B, users' logging off both MPD-B and User2's attempts at unauthorized access to file D and file E on MPB-A.

2.7.3.2 Reserved

2.7.3.3 Reserved

2.7.4 Expected Output

The output from the FD shall include the audit trail described above, both printed and copied to a 9 track 6250 bpi tape.

2.7.5 Reserved

2.8 FD 8 - LANGUAGE INTEGRATION

2.8.1 Objective

Demonstrate the integration capabilities of the languages proposed. Show that, on each proposed processor, programs written in one of the proposed languages can call compiled sub-routines written in any of the other proposed languages. In addition, demonstrate the ability of the proposed languages to call routines from the proposed X Windows, PHIGS, and DBMS packages.

2.8.2 RFP References

C.3.2.b
C.4.10.14
C.4.10.15
C.4.10.16
C.4.4
C.4.6

2.8.3 Instructions

The Offeror will create the program source files described in the Program section below. There is one program in each of the compiled languages. This program calls subroutines to be written in each of the other supported languages. It also demonstrates required integration with the required graphics and DBMS packages.

The same FORTRAN, COBOL, C, and 4GL source code shall be used on all processors, to demonstrate their source code compatibility.

All source code used to fulfill this FD must be provided in printed form and on tape.

If, in link-editing the programs, library routines must be included to produce executable code, only the standard libraries provided with the proposed compilers and the proposed DBMS, X Windows, and PHIGS libraries may be used. No libraries or object code specific to these programs and generated from source code external to the files described in the Program section may be used.

The Offeror will document the commands used to compile and produce executable code from the source code.

File name extensions used in this FD are for example purposes only. The Offeror may use different file name extensions if necessary to perform the FD. The actual file name extensions used for each file referred to in this FD shall be documented.

The Offeror will create a test database with the proposed DBMS to be used with this FD. The database shall consist of a single table LangTestTable with two columns; each column shall hold a 32 bit integer. The Offeror will use a standard utility which in an integral part of the DBMS (not a re-engineered application program) to load ASCII files to populate the table with the data specified in the Data section below.

Processing Environment

The following hardware shall be used for this FD:

MPA-A	Multi-user Processor Class A on LAN A
MPB-A	Multi-user Processor Class B on LAN A
MPC-A	Multi-user Processor Class C on LAN A
MPD-B	Multi-user Processor Class D on LAN B
MPE-A	Multi-user Processor Class E on LAN A
PSN-A	Serial Printer Narrow on LAN A
WA-A	Advanced Workstation on LAN A
WB-A	Basic Workstation on LAN A
WP-B	Personal Workstation on LAN B
WD-A	Administration Workstation in LAN A
WPT-B	Portable Workstation on LAN B

2.8.3.1 Script

2.8.3.1.1 Setup Script

a. Make the following program source files, as described in the Program section below, available on the distributed file system:

Subroutines	Wksta. Progs	MP Programs
ASMSUB.SRC	ASMWSPGM.SRC	ASMMPPGM.SRC
C__SUB.SRC	C__WSPGM.SRC	C__MPPGM.SRC
COBSUB.SRC	FORWSPGM.SRC	COBMPPGM.SRC
FORSUB.SRC	GENWSPGM.SRC	FORMPPGM.SRC

b. Create a database using the proposed DBMS; populate it with the data specified in the Data section below. Make the database available on the distributed file system.

c. Insure that an X-Client is available on the network.

2.8.3.1.2 Script for Workstations

The following steps shall be completed on a workstation of each proposed type:

a. Compile the subroutine ASMSUB.SRC prepared for this processor into the object code file ASMSUB.OBJ using the proposed assembler. Copy ASMSUB.SRC and ASMSUB.OBJ to tape.

b. Compile the subroutine C__SUB.SRC into the object code file C__SUB.OBJ using the proposed C compiler. Copy C__SUB.SRC and C__SUB.OBJ to tape.

c. Compile the subroutine FORSUB.SRC into the object code file FORSUB.OBJ using the proposed FORTRAN compiler. Copy FORSUB.SRC and FORSUB.OBJ to tape.

d. Assemble the workstation program ASMWSPGM.SRC prepared for this processor to object code with the proposed assembler for this processor; link the resulting object code with the C__SUB and FORSUB object code and any required standard libraries to produce an executable file ASMWSPGM. Copy ASMWSPGM.SRC and ASMWSPGM to tape.

e. Execute ASMWSPGM.

f. Produce a printed copy of the output the program directs to the default device.

g. Compile the workstation program C__WSPGM.SRC to object code with the proposed C compiler and Embedded SQL C Preprocessor; link the resulting object code with the FORSUB and ASMSUB object code and any required standard libraries, DBMS libraries, X Window libraries, and PHIGS libraries to produce an executable file C__WSPGM. (When compiling on any workstation type which is not required to support PHIGS, null-execution stubs may be linked in instead of PHIGS libraries.) Copy C__WSPGM.SRC and C__WSPGM to tape.

h. Execute C__WSPGM. When executing upon an Advanced Workstation or Basic Workstation, supply the value 1 for the integer parameter passed to the program. When executing on a Personal Workstation or Portable Workstation, supply the value 0. This parameter controls whether PHIGS access is attempted.

i. Verify that the program causes the X Server to display a window as described in the Program section below. Use the mouse to close the window in accordance with the logic in the Program section below.

j. If executing on an Advanced or Basic Workstation, verify that the program uses the PHIGS graphics libraries to produce windows on a bit-mapped display as described in the Program section below.

k. Produce a printed copy of the output the program directs to the default output device.

l. Compile the workstation program FORWSPGM.SRC to object code with the proposed FORTRAN compiler and Embedded SQL FORTRAN Preprocessor; link the resulting object code with the C__SUB and ASMSUB object code and any required standard libraries, DBMS libraries, X Window libraries, and PHIGS libraries to produce an executable file FORWSPGM. (When compiling on any workstation type which is not required to support PHIGS, null-execution stubs may be linked in instead of PHIGS libraries.) Copy FORWSPGM.SRC and FORWSPGM to tape.

m. Execute FORWSPGM. When executing upon an Advanced Workstation or Basic Workstation, supply the value 1 for the integer parameter passed to the program. When executing on a Personal Workstation or Portable Workstation, supply the value 0. This parameter controls whether PHIGS access is attempted.

n. Verify that the program causes the X Server to display a window as described in the Program section below. Use the mouse to close the window in accordance with the logic in the Program section below.

o. If executing on an Advanced or Basic Workstation, verify that the program uses the PHIGS graphics libraries to produce windows on a bit-mapped display as described in the Program section below.

p. Produce a printed copy of the output the program directs to the default output device.

q. Using the proposed application generation language, create an application which performs the actions listed in the program section under the GENWSPGM.SRC section. Perform any necessary precompilation, compilation, and linkage.

r. Compile the workstation program FORWSPGM.SRC to object code with the proposed FORTRAN compiler and Embedded SQL FORTRAN Preprocessor; link the resulting object code with the C__SUB and ASMSUB object code and any required standard libraries, DBMS libraries, X Window libraries, and PHIGS libraries to produce an executable file FORWSPGM. (When compiling on any workstation type which is not required to support PHIGS, null-execution stubs may be linked in instead of PHIGS libraries.) Copy FORWSPGM.SRC and FORWSPGM to tape.

s. Execute FORWSPGM. When executing upon an Advanced Workstation or Basic Workstation, supply the value 1 for the integer parameter passed to the program. When executing on a Personal Workstation or Portable Workstation, supply the value 0. This parameter controls whether PHIGS access is attempted.

t. Verify that the program causes the X Server to display a window as described in the Program section below. Use the mouse to close the window in accordance with the logic in the Program section below.

u. If executing on an Advanced or Basic Workstation, verify that the program uses the PHIGS graphics libraries to produce windows on a bit-mapped display as described in the Program section below.

v. Produce a printed copy of the output the program directs to the default output device.

w. Using the proposed application generation language, create an application which makes calls to the routines FORSUB, C__SUB, COBSUB, and ASMSUB. Demonstrate that it properly executes those routines.

2.8.3.1.3 Script for Multi-User Processors

The following steps shall be completed on a multi-user processor of each class:

a. Assemble the subroutine ASMSUB.SRC for this processor to the object code file ASMSUB.OBJ using the proposed assembler. Copy ASMSUB.SRC and ASMSUB.OBJ to tape.

b. Compile the subroutine C__SUB.SRC to the object code file C__SUB.OBJ using the proposed C compiler. Copy C__SUB.SRC and C__SUB.OBJ to tape.

c. Compile the subroutine COBSUB.SRC to the object code file COBSUB.OBJ using the proposed FORTRAN compiler. Copy COBSUB.SRC and COBSUB.OBJ to tape.

d. Compile the subroutine FORSUB.SRC to the object code file FORSUB.OBJ using the proposed FORTRAN compiler. Copy FORSUB.SRC and FORSUB.OBJ to tape.

e. Assemble the multi-user processor program ASMMPPGM.SRC prepared for this processor to object code with the proposed assembler for this processor; link the resulting object code with the C__SUB, COBSUB and FORSUB object code and any required standard libraries to produce an executable file ASMMPPGM. Copy ASMMPPGM.SRC and ASMMPPGM to tape.

f. Execute ASMMPPGM.

g. Produce a printed copy of the output the program directs to the default device.

h. Compile the multi-user processor program C__MPPGM.SRC to object code with the proposed C compiler and Embedded SQL C Preprocessor; link the resulting object code with the FORSUB, COBSUB, and ASMSUB object code and any required standard libraries, DEMS libraries, X Window libraries, and PHIGS libraries to produce an executable file C__MPPGM. Copy C__MPPGM.SRC and C__MPPGM to tape.

i. Execute C__MPPGM.

j. Verify that the program causes the X Server to display a window as described in the Program section below. Use the mouse to close the window.

k. Verify that the program uses the PHIGS graphics libraries to produce windows on a bit-mapped display as described in the Program section below.

l. Produce a printed copy of the output the program directs to the default output device.

m. Compile the multi-user processor program COBMPPGM.SRC to object code with the proposed COBOL compiler and Embedded SQL COBOL preprocessor; link the resulting object code with the C__SUB, ASMSUB and FORSUB object code and any required standard libraries to produce an executable file COBMPPGM. Copy COBMPPGM.SRC and COBMPPGM to tape.

n. Execute COBMPPGM.

o. Produce a printed copy of the output the program directs to the default device.

p. Compile the multi-user processor program FORMPPGM.SRC to object code with the proposed FORTRAN compiler and Embedded SQL FORTRAN Preprocessor; link the resulting object code with the C__SUB, COBSUB, and ASMSUB object code and any required standard libraries, DBMS libraries, X Window libraries, and PHIGS libraries to produce an executable file FORMPPGM. Copy FORMPPGM.SRC and FORMPPGM to tape.

q. Execute FORMPPGM.

r. Verify that the program causes the X Server to display a window as described in the Program section below. Use the mouse to close the window.

s. Verify that the program uses the PHIGS graphics libraries to produce windows on a bit-mapped display as described in the Program section below.

t. Produce a printed copy of the output the program directs to the default output device.

2.8.3.2 Data

The ASCII data required for this FD occurs in Appendix D.

2.8.3.3 Programs

2.8.3.3.1 ASMSUB.SRC

For each proposed processor, the Offeror will create this file which shall consist of source code for a sub-routine named ASMSUB in the assembly language of the processor. The subroutine will print the message "In Assembly Routine" on the default output device. The subroutine will take two 32 bit integer arguments, subtract the second from the first, and return the result. The arguments shall be passed and the value returned according to the conventions established by the proposed compilers for FORTRAN, C, and COBOL.

2.8.3.3.2 C__SUB.SRC

The Offeror will create this file which shall consist of C source code for a function named C__SUB. The function shall print the message "In C Routine" on the default output device. The function shall take two 32 bit integer arguments, subtract the second from the first, and return the result.

2.8.3.3.3 COBSUB.SRC

The Offeror will create this file which shall consist of source code for a COBOL subroutine named COBSUB. The subroutine shall print the message "In COBOL Routine" on the default output device. The subroutine shall take three 32 bit integer arguments. It will assign the value obtained from subtracting the second from the first to the third.

2.8.3.3.4 FORSUB.SRC

The Offeror will create this file which shall consist of FORTRAN source code for a function named FORSUB. The function shall print the message "In FORTRAN Routine" on the default output device (such as the workstation display.) The function shall take two 32 bit integer arguments, subtract the second from the first, and return the result.

2.8.3.3.5 ASMWSPGM.SRC

For each proposed workstation processor, the Offeror will create this file which shall consist of assembly language source code for a program to accomplish the following tasks:

a. Call the function FORSUB with arguments 17384 and 9065.

b. Print the result on the default output device.

c. Call the function C__SUB with arguments 9065 and 8319.

d. Print the result on the default output device.

2.8.3.3.6 C__WSPGM.SRC

The Offeror will create this file which shall consist of a program in C source code with embedded SQL. The program shall accept one integer parameter called DoGraphics. The program shall perform the following tasks:

a. With an SQL query, read the column values of the first row of the table LangTestTable into 32 bit integer program variables X and Y.

b. Print the value of the variables X and Y.

c. Call the routine ASMSUB using the two variables as arguments. Assign the return value to the variable Z.

d. Print the value of the variables X, Y, and Z.

e. Call the routine FORSUB using the variables Y and Z as arguments. Assign the return value to the variable X.

f. Print the value of the variables X, Y, and Z.

g. Repeat steps 1-6 for each succeeding row in the table.

h. Use the X Window Library for the proposed C compiler to:

   1. Establish contact with an X server.

    2. Create and display a window on the device controlled by the X server. Display within the window the text - Demonstration of C X Window Library.

    3. Remove the window when the user presses a mouse button while the pointer resides within the window.

i. If the parameter DoGraphics is equal to 1, create a window on a bit-mapped display using calls to the PHIGS library routines and display the text Demonstration of C Access to PHIGS Library in the window.

2.8.3.3.7 FORWSPGM.SRC

The Offeror will create this file which shall consist of a program in FORTRAN source code with embedded SQL. The program shall accept one integer parameter called DoGraphics. The program shall perform the following tasks:

a. With an SQL query, read the column values of the first row of the table LangTestTable into 32 bit integer program variables X and Y.

b. Print the value of the variables X and Y.

c. Call the routine ASMSUB using the two variables as arguments. Assign the return value to the variable Z.

d. Print the value of the variables X, Y, and Z.

e. Call the routine C__SUB using the variables Y and Z as arguments. Assign the return value to the variable X.

f. Print the value of the variables X, Y, and Z.

g. Repeat steps 1-6 for each succeeding row in the table.

h. Use the X Window Library bindings for the proposed FORTRAN compiler to:

    1. Establish contact with an X server.

2. Create and display a window on the device controlled by the X server. Display within the window the text Demonstration of FORTRAN X Window Library.

3. Remove the window when the user presses a mouse button while the pointer resides within the window.

i. If the parameter DoGraphics is equal to 1, create a window on a bit-mapped display using calls to the PHIGS library routines and display the text Demonstration of FORTRAN Access to PHIGS Library in the window.

2.8.3.3.8 GENWSPGM.SRC

The Offeror will input program specifications appropriate to the proposed application generator. If possible, the input shall be in the form of source code or a file containing program specifications. If that is not possible, the Offeror will input the necessary specification or control statements at the workstation during the demonstrations and document the process of input. The program shall perform the following tasks:

a. With an SQL query, read the column values of the first row of the table LangTestTable into 32 bit integer program variables X and Y.

b. Print the value of the variables X and Y.

c. Call the routine ASMSUB using the two variables as arguments. Assign the return value to the variable Z.

d. Print the value of the variables X, Y, and Z.

e. Call the routine FORSUB using the variables Y and Z as arguments. Assign the return value to the variable X.

f. Print the value of the variables X, Y, and Z.

g. Call the routine C__SUB using the variables Y and Z as arguments. Assign the return value to the variable X.

h. Print the value of the variables X, Y, and Z.

i. Repeat steps 1-8 for each succeeding row in the table.

2.8.3.3.9 ASMMPPGM

For each proposed multi-user processor, the Offeror will create this file which shall consist of assembly language source code for a program to accomplish the following tasks:

a. Call the function FORSUB with arguments 17384 and 9065.

b. Print the result on the default output device.

c. Call the function C__SUB with arguments 9065 and 8319.

d. Print the result on the default output device.

e. Call the function COBSUB with arguments 746 and 9065, and an additional argument with value set to 0.

f. Print the new value of all three arguments.

2.8.3.3.10 C__MPPGM.SRC

The Offeror will create this file which shall consist of a program in C source code with embedded SQL. The program shall perform the following tasks:

a. With an SQL query, read the column values of the first row of the table LangTestTable into 32 bit integer program variables X and Y.

b. Print the value of the variables X and Y.

c. Call the routine ASMSUB using the two variables as arguments. Assign the return value to the variable Z.

d. Print the value of the variables X, Y, and Z.

e. Call the routine FORSUB using the variables Y and Z as arguments. Assign the return value to the variable X.

f. Print the value of the variables X, Y, and Z.

g. Call the routine COBSUB using the variable X, Y, and Z as arguments.

h. Print the value of the variables X, Y, and Z.

i. Repeat steps 1-8 for each succeeding row in the table.

j. Use the X Window Library bindings for the proposed C compiler to:

    1. Establish contact with an X server.

    2. Create and display a window on the device controlled by the X server. Display within the window the text - Demonstration of C X Window Library.

    3. Remove the window when the user presses a mouse button while the pointer resides within the window.

k. Create a window on a bit-mapped display using calls to the PHIGS library routines; display the text Demonstration of C Access to PHIGS Library in the window.

2.8.3.3.11 COBMPPGM.SRC

The Offeror will create this file which shall consist of a program in COBOL source code with embedded SQL. The program shall perform the following tasks:

a. With an SQL query, read the column values of the first row of the table LangTestTable into 32 bit integer program variables X and Y.

b. Print the value of the variables X and Y.

c. Call the routine ASMSUB using the two variables as arguments. Assign the return value to the variable Z.

d. Print the value of the variables X, Y, and Z.

e. Call the routine FORSUB using the variables Y and Z as arguments. Assign the return value to the variable X.

f. Print the value of the variables X, Y, and Z.

g. Call the routine C__SUB using the variable X and Y as arguments. Assign the returned value to the variable Z.

h. Print the value of the variables X, Y, and Z.

i. Repeat steps 1-8 for each succeeding row in the table.

2.8.3.3.12 FORMPPGM.SRC

The Offeror will create this file which shall consist of a program in FORTRAN source code with embedded SQL. The program shall perform the following tasks:

a. With an SQL query, read the column values of the first row of the table LangTestTable into 32 bit integer program variables X and Y.

b. Print the value of the variables X and Y.

c. Call the routine ASMSUB using the two variables as arguments. Assign the return value to the variable Z.

d. Print the value of the variables X, Y, and Z.

e. Call the routine C__SUB using the variables Y and Z as arguments. Assign the return value to the variable X.

f. Print the value of the variables X, Y, and Z.

g. Call the routine COBSUB using the variable X, Y, and Z as arguments.

h. Print the value of the variables X, Y, and Z.

i. Repeat steps 1-8 for each succeeding row in the table.

j. Use the X Window Library bindings for the proposed FORTRAN compiler to:

    1. Establish contact with an X server.

    2. Create and display a window on the device controlled by the X server. Display within the window the text - Demonstration of FORTRAN X Window Library.

    3. Remove the window when the user presses a mouse button while the pointer resides within the window.

k. Create a window on a bit-mapped display using calls to the PHIGS library routines; display the text Demonstration of FORTRAN Access to PHIGS Library in the window.

2.8.4 Expected Output

The output expected on the default output device for each program is listed below. The same program running on different processors should produce identical output.

2.8.4.1 ASMWSPGM Output

```
In FORTRAN Routine
8319
In C Routine
764
```

2.8.4.2 C_WSPGM Output

```
17384 9065
In Assembly Routine
17384 9065 8319
In FORTRAN Routine
764 9065 8319
21009 893
In Assembly Routine
21009 893 20116
In FORTRAN Routine
-19223 893 20116
```

2.8.4.3 FORWSPGM Output

```
17384 9065
In Assembly Routine
17384 9065 8319
In C Routine
764 9065 8319
21009 893
In Assembly Routine
21009 893 20116
In C Routine
-19223 893 20116
```

2.8.4.4 ASMMPPGM Output

```
In FORTRAN Routine
8319
In C Routine
764
In COBOL Routine
764 9065 -8319
```

2.8.4.5 C__MPPGM Output

```
17384 9065
In Assembly Routine
17384 9065 8319
In FORTRAN Routine
764 9065 8319
In COBOL Routine
764 9065 -8319
21009 893
In Assembly Routine
21009 893 20116
In FORTRAN Routine
-19223 893 20116
In COBOL Routine
-19223 893 -20116
```

2.8.4.6 COBMPPGM Output

```
17384 9065
In Assembly Routine
17384 9065 8319
In FORTRAN Routine
764 9065 8319
In C Routine
764 9065 -8319
21009 893
In Assembly Routine
21009 893 20116
In FORTRAN Routine
-19223 893 20116
In C Routine
-19223 893 -20116
```

2.8.4.7 FORMPPGM Output

```
17384 9065
In Assembly Routine
17384 9065 8319
In C Routine
764 9065 8319
In COBOL Routine
764 9065 -8319
21009 893
In Assembly Routine
21009 893 20116
In C Routine
-19223 893 20116
In COBOL Routine
-19223 893 -20116
```

2.8.4.8 Generated Application Output

```
17384 9065
In Assembly Routine
17384 9065 8319
In FORTRAN Routine
764 9065 8319
In C Routine
764 9065 8319
21009 893
In Assembly Routine
21009 893 20116
In FORTRAN Routine
-19223 893 20116
In C Routine
-19223 893 20116
```

2.8.5 Reserved

2.9 FD 9 - CONNECTIVITY

2.9.1 Objective

Demonstrate the robustness of the proposed local area networks and the proposed wide area network, implemented with simulated FTS2000 dedicated 56 Kbps links, linking the local area networks. Demonstrate the ability of the networks to recognize and recover from transmission and hardware errors. Demonstrate the network management function of fault isolation. Demonstrate electronic mail over the networks.

2.9.2 RFP References

C.5.4
C.5.5

2.9.3 Instructions

In this demonstration, the local area networks (LANs) and the wide area network (WAN) shall identify and react to nodes which are down or not responding. The configuration of the LANs and the WAN in this FD shall conform to the Offeror's Network Engineering and Management Plan. The network software for each LAN shall provide reports of all network activity for the duration of this FD. Additionally, the network analyzer supplied by the Offeror for each LAN shall be activated and recording for the duration of this FD. All reports shall be printed and supplied to the Government at the conclusion of this FD.

The WAN shall demonstrate the Offeror's understanding and implementation of the FTS2000 Dedicated Transmission Service.

Processing Environment

The following hardware shall be used for this FD:

MPE-A	Multi-user Processor Class E on LAN A
PPM-A	Page Printer Mid-Range on LAN A
PPL-B	Page Printer Low-Range on LAN B
WA-C	Advanced Workstation on LAN C
WP-B	Personal Workstation on LAN B
XT-A	X-Terminal on LAN A
XT-C	X-Terminal on LAN C

2.9.3.1 Script

a. On XT-A, WP-B, and XT-C open applications on three windows each. Each application shall require a continuous display to a screen and an output to a peripheral printer at 30 second intervals. XT-A:WINDOW1 will run on MPE-A; XT-A:WINDOW2 will run on WP-B; and XT-A:WINDOW3 will run on WA-C. Similarly, WP-B:WINDOW1 shall run on MPE-A, and so on. Additionally, a window will be opened on one X-terminal or workstation on each LAN which will be used to monitor the network (called the Monitors in this Functional Demonstration). Each printer should be available over the WAN but not locally (on the same LAN) to the processor writing to it.

b. From each of the Monitors, monitor the WAN for one minute and print a report including network activity, percentage of server utilization, and peripheral status. This step shall produce three reports, one each from LANs A, B, and C. These reports shall be verified against each other and should match node for node across the WAN.

c. During the next five minutes, an operator shall cause errors to appear in the system. This shall be done by taking peripherals off line, rebooting selected processors, disconnecting various network links, disconnecting WAN links, and other methods suggested by the Offeror's configuration; for example,

   1. MPE-A will be rebooted.

   2. A WAN connection between LAN B and LAN C will be broken and reconnected.

   3. PLP-B will be turned off during printing and turned back on.

   The networks should handle each of these interruptions and other similar interruptions with minimal system impact. During the unwitnessed demonstrations, these error causing events shall be written down and attached to the output from step 4 for each error event.

d. During the above five minutes system activity reports as described in step 2 shall be generated each time the network is changed; i.e., when a node is taken off line, etc.

e. After the system has been restored to its original state, generate another set of system activity reports from the Monitors. These reports shall be verified against the reports obtained in step 2.

f. Using the proposed e-mail package, send a copy of the report to each user logged on to XT-A, WP-B, and XT-C. Do not use e-mail addresses such as 'all'; each user shall be uniquely identified.

g. Read the e-mail from each node.

h. Print the e-mail from each WINDOW3 to any printer on a different LAN.

i. Print three network activity statistics reports, one from each Monitor, for the time period of this demonstration. This report shall include (a) WAN and LAN utilization, (b) WAN and LAN traffic in terms of transmitted characters, frames, and packets, (c) average packet size, (d) collision count on the each LAN, (e) user connect time, and (f) traffic between origin and destination points.

2.9.3.2 Data

Any data required by the programs described in step one shall be provided by the Offeror. The data shall be kept in text files consistent with the proposed operating system.

2.9.3.3 Programs

The programs which run on the X-Terminals and the workstation windows shall be supplied by the Offeror. An example of a continuous screen program is a polygon bouncing around a window. It is sufficient to simply write a brief message and a time stamp to the printer for the 30 second output described in step 1.

2.9.4 Expected Output

The output of this demonstration shall include the system activity reports, the network activity statistics reports, and the network analyzer outputs. In the case of unwitnessed demonstrations, the output shall also include the actions taken to induce network errors. These error action descriptions shall be of sufficient detail to allow BLM personnel to reproduce them during the Witnessed Functional Demonstrations.

2.9.5 **Reserved**

2.10 FD 10 - SYSTEM ADMINISTRATION

2.10.1 Objective

Demonstrate the system administration and device management capabilities of the proposed operating system and associated utilities.

2.10.2 RFP References

C.4.2.1.4

2.10.3 Instructions

In this FD, the terms attach and detach refer to logical addition and removal of processors, devices, and networks by the operating system. The terms do not refer to physical removal or disconnection of components, nor to removal of power from the components, etc. Attachment and detachment shall be accomplished by the execution of commands submitted to the operating system.

Processing Environment

The following hardware shall be used for this FD:

MPA-A	Multi-user Processor Class A on LAN A
PLP-A	Pen Plotter on LAN A
PPM-A	Page Printer Mid-Range on LAN A
WA-A	Advanced Workstation on LAN A
WP-B	Personal Workstation on LAN B

The following devices shall be connected to MPA-A:

a. MagDisk, a magnetic disk drive

b. OptDisk, an optical disk drive

c. MagTapeDrive, a magnetic tape drive

The FD shall begin with MagDisk and OptDisk mounted on MPA-A, and MagTapeDrive, PPM-A, and PLP-A attached to MPA-A.

2.10.3.1 Script

2.10.3.1.1 Script for Account Management

a. Display a list of all user accounts on MPA-A, with a description of the privileges and access rights of each account. Print the list on the system line printer attached to MPA-A.

b. Create a new account on MPA-A with minimal privileges or access rights.

c. Display and print (on PPM-A) a list of all user accounts on MPA-A, with a description of the privileges and access rights of each account.

d. Individually add each type of privilege and access right to the new account.

e. Display and print a list of all user accounts on MPA-A, with a description of the privileges and access rights of each account.

f. Delete the new account from MPA-A.

g. Individually remove each type of privilege and access right from one account.

h. Display and print a list of all user accounts on MPA-A, with a description of the privileges and access rights of each account.

2.10.3.1.2 Script for Automatic Logoff

a. On a multi-user processor, set a limit for the length of time an account User1 may remain idle before it is automatically logged off.

b. Demonstrate that after that amount of time elapses, the user with the account User1 is automatically logged off. (This step may be performed later in the script if the delay needs to be more than two minutes.)

2.10.3.1.3 Script for Magnetic Disk and Tape Device Control

a. Display and print a list of all storage devices attached to MPA-A.

b. Identify a tape file, henceforth called File1, which can be loaded into the proposed file system and printed on PPM-A. The tape volume on which it resides is henceforth called MagTapeVol1.

c. Mount MagDisk on MPA-A.

d. Attach MagTapeDrive to MPA-A.

e. Display and print a list of all storage devices attached to MPA-A.

f. Mount tape MagTapeVol1 on MagTapeDrive.

g. Read file File1 from MagTapeVol onto MagDisk.

h. Mount scratch tape MagTapeVol2 on MagTapeDrive.

i. Detach MagTapeDrive from MPA-A.

j. Attempt to write File1 to MagTapeVol2.

k. Attach MagTapeDrive to MPA-A.

l. Mount tape MagTapeVol2 on MagTapeDrive.

m. Write File1 to MagTapeVol2.

2.10.3.1.4 Script for Optical Disk Device Control

a. Display and print a list of all storage devices attached to MPA-A.

b. Copy File1 to OptDisk.

c. Dismount OptDisk from MPA-A.

d. Display and print a list of all storage devices attached to MPA-A.

e. Attempt to copy File1 to OptDisk.

f. Mount OptDisk on MPA-A.

g. Copy File1 to OptDisk.

h. Logically write protect OptDisk via operating system command.

i. Attempt to copy File1 to OptDisk.

2.10.3.1.5 Script for Printer Control

a. Display and print a list of all local and remote printers available to MPA-A.

b. Logically attach PPM-A to MPA-A.

c. Display and print a list of all local and remote printers available to MPA-A.

d. Print File1 on PPM-A.

e. Logically detach PPM-A from MPA-A.

f. Display and print a list of all local and remote printers available to MPA-A.

g. Attempt to print File1 on PPM-A.

h. Logically attach PPM-A to MPA-A.

i. Print File1 on PPM-A.

2.10.3.1.6 Script for Plotter Control

a. Identify a file, henceforth called File2, which can be plotted on PLP-A.

b. Display and print a list of all local and remote printers available to MPA-A

c. Logically attach PLP-A to MPA-A.

d. Plot File2 on PLP-A.

e. Logically detach PLP-A from MPA-A.

f. Display and print a list of all local and remote printers available to MPA-A.

g. Attempt to plot File2 on PLP-A.

h. Logically attach PLP-A to MPA-A.

i. Plot File2 on PLP-A.

2.10.3.1.7 Script for Remote Access Control

Perform the following steps from WB-A, logged in to MPA-A.

a. Display and print a list of all workstations connected to MPA-A via LAN or WAN.

b. Create File3 in the portion of the file system which resides physically on workstation WA-A. The format and content of File3 are at the discretion of the Offeror.

c. Copy File3 to a file File4 in the portion of the file system which resides physically on workstation WA-C.

d. Logically detach WA-A from LAN A.

e. Attempt to read File3.

f. Attempt to read File4.

g. Logically detach MPA-A and LAN A from the WAN.

h. Attempt to read File4.

i. Logically attach MPA-A and LAN A to the WAN.

j. Attempt to read File4.

k. Logically attach WA-A to LAN A.

l. Attempt to read File3.

2.10.3.1.8 Script for LAN Control

Perform the following steps from WB-A, logged in to MPA-A.

a. Display and print a list of all LANs connected to MPA-A.

b. Create File5 in the portion of the file system which resides physically on workstation WP-B. The format and content of File5 are at the discretion of the Offeror.

c. Attempt to read File5.

d. Logically detach LAN B from MPA-A.

e. Attempt to read File5.

f. Logically attach LAN B to MPA-A.

g. Attempt to read File5.

2.10.3.2 Data

The data required for this FD shall be supplied by the Offeror in the form of five files. One file, File1, shall be a file residing on a magnetic tape volume, MagTapeVol1, which can be loaded into the proposed file system and printed on PPM-A. The second file, File2, shall be a file residing in the file system which can be plotted on PLP-A. The format and content of File3, File4, and File5 are at the discretion of the Offeror. All these files may be files generated from Government supplied files or files generated by the Offeror.

2.10.3.3 Reserved

2.10.4 Expected Output

The output from the FD shall include the printed and plotted results of the steps in the script above.

The output from the FD shall include system console logs for all CPUs in the MPA-A configurations and all workstation dialogs which demonstrate the success or failure of the various attempts at device and file access defined in the script above.

2.10.5 Reserved

2.11 FD 11 - BACKUP AND RESTORE

2.11.1 Objective

Demonstrate the backup and recovery capabilities of the proposed file system and the associated utilities. Demonstrate the ability of any processor to back up any section of the distributed file system. Demonstrate restoration of files to different multi-user processor class and workstation class other than those from which backup occurred. Demonstrate that both magnetic and optical media can be backed up transparently.

2.11.2 RFP References

C.3.3
C.3.3.4
C.3.3.6
C.3.4
C.4.2.1.4
C.4.7.1
C.5.4
C.5.5

2.11.3 Instructions

In this demonstration, a test section of the distributed file system will be backed up and restored. This test section shall contain at least 10 megabytes of executable files and data files of various lengths and contents; the files shall be distributed through a hierarchy of directories at least three levels deep, with directory Dir1 as the highest level directory.

The organization of Dir1 and its subdirectories is at the discretion of the Offeror, within the following guidelines. Dir1 and its subdirectories shall contain both files which have been changed within the last 24 hours and files which have not been changed within the last 24 hours. The text file TEXT, described in the Data section below, shall reside in the directory Dir1 itself. All the files shall reside on magnetic media local to MPA-A at the start of the FD.

Processing Environment

The following hardware shall be used for this FD:

MPA-A	Multi-user Processor Class A on LAN A
MPD-B	Multi-user Processor Class D on LAN B
WA-A	Advanced Workstation on LAN A
WP-B	Personal Workstation on LAN B

The following devices shall be connected to MPA-A:

a. MagTapeDrive1, a magnetic tape drive attached to MPA-A

b. MagTapeDrive2, a magnetic tape drive attached to MPD-B

c. BackupDev1, a removable backup device attached to WA-A.

d. BackupDev2, a removable backup device attached to WP-B.

In the steps in the script below, each backup shall be saved to a separate tape or removable medium.

2.11.3.1 Script

a. Print the file TEXT in Dir1.

b. Execute a command to back up the contents of Dir1 to tape VOL001 on MagTapeDrive1. The command should not tie up the terminal from which it is issued after the back up commences.

c. When this backup to VOL001 is complete, schedule two backups, to backup BKP002 and BKP003, to take place 10 minutes in the future. Backup to BKP002 shall be a full backup of all files within Dir1. BKP002 shall be mounted on BackupDev1. Backup to BKP003 shall be an incremental backup of those files in Dir1 which have been changed in the last 24 hours. BKP003 shall be mounted on BackupDev2.

d. In the ensuing 10 minutes, edit the file TEXT in Dir1 and remove its first line.

e. Print the file TEXT in Dir1.

f. Transfer VOL001 to MagTapeDrive2. Restore from it to create a new directory Dir2 which is a duplicate of Dir1, except that it shall reside in that portion of the file system residing on an optical storage device physically connected to MPD-B. (VOL001 should contain the original file TEXT).

g. From MPD-B, create a backup of Dir2 on VOL004.

h. Wait for backups to BKP002 and BKP003 to complete. Transfer BKP003 to WA-A, and restore it to Dir2. (BKP003 should contain the modified file TEXT.)

i. Print the file TEXT in Dir2.

j. Delete Dir2 and all its contents.

k. Transfer VOL004 to MPA-A. Restore the contents of Dir1 from the backup of Dir2 on VOL004. (VOL004 should contain the original file TEXT).

l. Print the file TEXT in Dir1.

m. Transfer BKP002 to BackupDev2. From it, restore only the file TEXT across the WAN to Dir1 on MPA-A. (BKP002 should contain the modified file TEXT.)

n. Print the file TEXT in Dir1.

o. Back up Dir1 to VOL005.

p. Log on to MPA-A and back up all files resident on WA-A and WP-B.

2.11.3.2 Data

The data for this FD is described in Appendix D.

2.11.3.3 Reserved

2.11.4 Expected Output

The output from this demonstration shall include the various backup tapes and removable backup media created in the demonstration, as well as logs of the backups which occurred from all CPUs in the MPA-A and MPD-B configuations, and printed versions of the file TEXT.

2.11.5 Reserved

2.12 RESERVED

2.13 FD 13 - CPU PRECISION TEST

2.13.1 Objective

Demonstrate the ability of the CPU to perform floating-point calculations with the required precision.

2.13.2 RFP References

C.4.3.2
C.4.6.2

2.13.3 Instructions

In this FD, the Offeror will compile and execute three Government-supplied programs on each type of multi-user processor and workstation proposed. The programs shall be compiled with the proposed FORTRAN 77 compiler. The output of the programs will demonstrate the precision with which the CPU and proposed FORTRAN 77 compiler perform floating point calculations.

Source code for each of the three programs is given in the Program section below; the source code is also available in the text files described in the Data section. The Offeror may modify this source code only to allow the programs to merely compile and run. The programs may not be modified to change the sequence or number of arithmetic operations performed; no assignment statements or arithmetic expressions which involve floating point values may be changed, nor may the value to which any of the floating-point variables are initialized be changed. The Offeror will document any changes made to the source code, explaining in the documentation why the changes were necessary to allow the programs to compile and run. The Offeror will obtain Government approval of any changes at least two weeks prior to the Witnessed Demonstrations.

The same source files shall be used on all processors to demonstrate their source code compatibility.

If, in link-editing the programs, library routines must be included to produce executable code, only the standard libraries provided with the compiler may be used. No libraries specific to these programs may be used.

The Offeror will supply a printed version of the output of each of the programs, and a printed listing of the source (including any modifications, which shall be clearly identified). The Offeror will also document the commands used to produce the executable output from the source code. He shall supply on tape the source code and executable object code for each of the programs.

Processing Environment

The following hardware shall be used for this FD:

MPA-A	Multi-user Processor Class A on LAN A
MPB-A	Multi-user Processor Class B on LAN A
MPC-A	Multi-user Processor Class C on LAN A
MPD-B	Multi-user Processor Class D on LAN B
MPE-A	Multi-user Processor Class E on LAN A
WA-A	Advanced Workstation on LAN A
WB-B	Basic Workstation on LAN B
WP-B	Personal Workstation on LAN B
WD-A	Administrative Workstation on LAN A
WPT-B	Portable Workstation on LAN B

2.13.3.1 Script

The following steps shall be performed on each proposed processor.

a. Copy the source files PRECIS.F77, IBMTST1.F77, and IBMTST4.F77 specified in the Data section shall be copied to the distributed file system. If necessary, they may be renamed.

b. Edit or reformat the files if necessary so that the proposed FORTRAN compiler may produce an executable object file. Document any changes in accordance with the instructions above.

c. Print the edited files and save them to tape.

d. The commands required to produce an executable object file from the source file derived from PRECIS.F77 shall be performed.

e. The object file shall be saved to tape.

f. The object file shall be executed; the output of the program shall be printed.

g. Steps 1-3 shall be repeated for each of the other source files: IBMTST1.F77 and IBMTST4.F77.

2.13.3.2 Data

A printout of the source code used in this demonstration is provided in Exhibit C-1. The source code is also provided in Appendix D in the form of fixed-record length ASCII files, one source line per record. The files are PRECIS.F77, IBMTST1.F77, and IBMTST4.77.

2.13.3.3 Programs

Listings of the programs PRECIS.F77, IBMTST1.F77, and IBMTST4.77 occur in Exhibit C-1.

2.13.4 Expected Output

Sample output from programs PRECIS.F77, IBMTST1.F77, and IBMTST4.77 occurs in Exhibit C-1.

2.13.5 Reserved

2.14 FD 14 - DISTRIBUTED GIS SUPPORT

2.14.1 Objective

Demonstrate the support of the geographic information system (GIS) for workstations and X-Terminals distributed over the LAN and WAN. Demonstrate that both spatial and alphanumeric data maintained by the GIS on a given multi-user processor can be accessed and modified by workstations and X-Terminals remote from that multi-user processor.

2.14.2 RFP References

C.3.3
C.3.4
C.4.3
C.5.4
C.5.5

2.14.3 Instructions

The Offeror will perform this FD using only the proposed GIS and the proposed operating system and its associated utilities. No other or re-engineered software shall be used for this FD.

Processing Environment

The following hardware shall be used for this FD:

HC-C	Color Hard Copy Unit on LAN C
MPB-A	Multi-user Processor Class B on LAN A
WB-A	Basic Workstation on LAN A
WA-C	Advanced Workstation on LAN C
XT-A	X-Terminal on LAN A
XT-C	X-Terminal on LAN C

Perform the steps described in the script section below once from each of the following four environments:

a. WB-A logged on to MPB-A

b. XT-A logged on to MPB-A

c. WA-C logged on to MPB-A via WAN

d. XT-C logged on to MPB-A via WAN

The commands used to perform the steps shall be the same in all four environments, and shall be documented by the Offeror.

Use the geographic data described in the Data section below and in Appendix D for this FD. Load this data so that it resides on MPB-A.

2.14.3.1 Script

a. Backup the files which will be modified in the course of the FD.

b. Display a subset of the supplied geographic data graphically as a map.

c. Select a named point feature within that subset by pointing to it with a proposed pointing device.

d. Display the alphanumeric data associated with that feature.

e. Produce a hardcopy version of the map display, with the selected feature indicated; and the associated alphanumeric data.

f. Reposition the feature.

g. Change the name of the feature.

h. Produce a hardcopy version of the modified map display, with the selected feature indicated; and the modified alphanumeric data.

i. Save the updated feature on MPB-A.

j. Redisplay the modified feature and its attributes in such a way as to require their being read from MPB-A.

k. Backup the files modified in the course of updating the feature.

2.14.3.2 Data

For this FD, use the data provided for the Software Re-engineering; that is the legal land data, resource data, and PCCS data for the 31 townships in northern New Mexico specified in Sections 2.0 through 4.0 in Appendix D.

2.14.3.3 Reserved

2.14.4 Expected Output

The output of the FD shall include the backups made on a 9 track 6250 bpi tape attached to MPB-A, as well as hardcopy versions of screens showing each feature before and after its modification.

2.14.5 Reserved

2.15 RESERVED

2.16 FD 16 - RASTER DEVICE SUPPORT AND VECTOR FEATURE EDITING

2.16.1 Objective

Demonstrate the capability of the proposed GIS to: 1) Scan in a map or photo on each of the proposed scanners and display the scanned images on a workstation; 2) Overlay vector features on a displayed, geographically registered image (e.g., photograph, satellite image, etc.) and provide the capability to edit vector features to their actual locations on the image; and, 3) Direct an output image and vector file to specified electrostatic plotters and film recorders via a LAN and WAN.

2.16.2 RFP References

C.3.4.3
C.3.6.2.2
C.3.6.3
C.3.6.5
C.3.6.6
J.11.3
J.11.3.1
J.11.3.1.2.1
J.11.3.1.2.6
J.11.3.1.2.7
J.11.3.1.4
J.11.3.1.4.4
J.11.3.1.4.5
J.11.3.1.4.6
J.11.3.1.4.7
J.11.3.2.11
J.11.3.2.12
J.11.3.2.12.1
J.11.3.2.12.2
J.11.3.2.12.3
J.11.3.2.12.4
J.11.3.2.14
J.11.3.2.14.5
J.11.3.2.20
J.11.3.2.20.1
J.11.3.2.20.2
J.11.3.3.1
J.11.3.3.1.7
J.11.3.3.1.8
J.11.3.3.1.18
J.11.3.3.2
J.11.3.3.2.20
J.11.3.3.2.21
J.11.3.3.3

J.11.3.3.3.1
J.11.3.3.3.2
J.11.3.3.3.3

2.16.3 Instructions

The intent of the FD is to demonstrate the capability of the vendor's system to capture, manipulate, and create output products based on both raster and vector data. During the FD, an aerial photograph and topographic quadrangle map will be captured and converted from an analog to digital raster file format through the application of scanning technology specified in the RFP. Following the data capture and conversion phase, the unregistered image data will be geometrically registered to a map base and displayed for enhancement in order to facilitate interactive vector editing. A vector data file will be simultaneously displayed with the enhanced raster image and interactively manipulated to add, delete, and modify information. Plotter and film products will be generated in order to demonstrate plotting and film writing capabilities in terms of the quality of output and as a confirmation of the vector editing process.

Processing Environment

The following hardware shall be used for this FD:

FRL-B	Large Color Film Recorder on LAN B
FRS-C	Small Color Film Recorder on LAN C
HC-C	Color Hard Copy Unit on LAN C
MPD-B	Multi-user Processor Class D on LAN B
PLE-C	Electrostatic Plotter on LAN C
SC-C	Color Scanner on LAN C
SPC-C	Photogrammetric Color Scanner on LAN C
WA-C	Advanced Workstation on LAN C

2.16.3.1 Script

2.16.3.1.1 Script for Scanning, Editing, and Hardcopy Generation

a. Scan the National Aerial Photography Program (NAPP) infrared photographic transparency (i.e., Photo1) using SPC-C. The resulting scanned data file shall be called File1. Produce a hardcopy of File1 on HC-C.

b. Display File1 as a false color composite image on WA-C.

c. Load the transportation vector data file (i.e., RDFILE2) supplied by the Government for the Turley Topographic Quadrangle map on WA-C. Produce a hardcopy of RDFILE2 on HC-C.

d. On WA-C, register (i.e., geometrically correct) File1 to the map projection of RDFILE2 using the ground control point file (i.e., RDFILE3) and digital elevation model (i.e., RDFILE4) supplied by the Government. The registered image output file shall be called File5. Produce a color hardcopy of RDFILE3 and RDFILE4 on HC-C.

e. Display File5 on WA-C as a false color composite image and produce a color hardcopy of File5 on HC-C.

f. On WA-C, enhance the displayed image to highlight the transportation associated features.

g. Display the vector data loaded in step #3 from RDFILE2 over the displayed registered image on WA-C.

h. On WA-C, compare the displayed registered image and vector transportation features and demonstrate the capability to selectively edit the displayed vector data. For this demonstration, vector editing shall include the addition of at least three new vectors, repositioning of three existing vectors to be coincident with the displayed image, and the deletion of at least two vector from the displayed vector data. The vectors to be edited will be identified by the Government representative during the interactive vector editing session.

i. The edited and unedited vectors from step #8 shall be saved as a new vector file, called File6, covering the same area as the original vector data set loaded in step #3. Produce a color hardcopy of File6 on HC-C.

j. Plot (called Plot1) the originals and new vector files (i.e., RDFILE2 and File6, respectively) in combination with the registered image (i.e., File5), (i.e., superpositioned upon the image) on PLE-C at a scale of 1:24,000 via LAN. The original (unedited) vector file (i.e., RDFILE2) shall be plotted as black lines and the new vector file (i.e., File6) shall be plotted as colors other than black. The underlying registered image data (i.e., File5) shall be plotted so as to be as similar a representation of the original infrared photographic transparency (i.e., photo1) as possible in hue and intensity.

k. Write the original and new vector files (i.e., RDFILE2 and File6) in combination with the registered image (i.e., File5) (i.e., superpositioned upon the image) to FRS-C as a positive film transparency, called Photo2. The original (unedited) vector file (i.e., RDFILE2) shall be written as black lines and the edited vector data file (i.e., File6) shall be written as colors other than black. The underlying registered image data (i.e., File5) shall be written to the positive film transparency (i.e., Photo2) so as to be as similar a representation as possible of the original infrared photographic transparency (i.e., Photo1) from step #1 in hue and intensity.

2.16.3.1.2 Script for Scanned Map

a. Scan the Government provided topographic quadrangle map (i.e., Map1) using SC-C at a scanning resolution of at least 500 by 500 dots per square inch. The output shall be a digital color composite file, called File7, with a six bit gray scale per color.

b. Display File7 onto WA-C. Produce a hard copy of File7 on HC-C.

c. Plot (called Plot3) the scanned map data file (i.e., File7) on PLE-C. The plotted output shall be as accurate a representation of the original topographic quadrangle map (i.e., Map1) in scale, size, and color as possible.

d. Write the scanned map data file (i.e., File7) on FRL-B. This output will be called Photo3. The written output (i.e., Photo3) shall yield a photographic print (called Photo2) which is an accurate representation of the original topographic quadrangle map (i.e., Map1) in size and color.

2.16.3.2 Data

Data for this demonstration includes Map1, a standard paper copy of the 1985 Turley, New Mexico USGS 7.5 minute topographic quadrangle map. It can be ordered from Map Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225.

Data for this demonstration also includes Photo1, a color infrared (CIR) positive film positive transparency of the southwest quarter of the Turley, New Mexico quadrangle derived from the National Aerial Photography Program NHAP-2 1:58,000 CIR photography flown on 6/18/86. It can be ordered, at $24.00, from the following address:

USDA-ASCS Aerial Photography Office
P.O. Box 30010 2222 West 2300 South
Salt Lake City, UT 84130-0010

Order Color Infrared (CIR) Cibs film positive (10 inch by 10 inch), NHAP Year NHAP2, Roll Number 363, Exposure Number 127.

The following data is supplied in Appendix D, Government Supplied Data:

a. RDFILE2: A standard USGS digital line graph of the transportation features associated with the topographic quadrangle map provided above (i.e., NAVAJO-RESERVOIR.AZ1.RDS10).

b. RDFILE3: An ASCII ground control point file associated with the Turley, New Mexico quadrangle.

c. RDFILE4: A standard USGS digital elevation model covering the same area as the topographic quadrangle map provided above (i.e., AZTEC.SE).

2.16.3.3 Reserved

2.16.4 Expected Output

The output from the scanning portion of this FD shall include two digital files. File1 shall contain a raster image of the NAPP aerial photograph and File7 shall contain an image of the scanned topographic quadrangle map. These outputs (i.e., File1 and File7) shall be displayed on the advanced workstation. Also, a copy of the raster image file of the scanned NAPP photograph (i.e., File1) shall be provided to the Government in the image transfer format specified in Appendix D.

The output from the editing portion of this FD shall be a new vector file (i.e., File6) containing the edited and original vectors (where not edited).

The output from the demonstration shall include a plot (i.e., Plot1) and a film product (i.e., Photo2) of the combined original and new vector data (i.e., File1 and File6, respectively), superpositioned upon the registered image (i.e., File5), as well as a plot (i.e., Plot3) and a film product (i.e., Photo3) of the scanned map data.

The output from the demonstration shall include the other hard copy output specified in the script.

2.16.5 Reserved

2.17 RESERVED

2.18 FD 18 - GIS EDGE MATCHING

2.18.1 Objective

Demonstrate the capability of edgematching lines, chains, or polygons across contiguous maps with a common theme and data type taking into consideration varying scales and/or projections.

2.18.2 RFP References

C.3.6.2.2
J.11.3.1.2.7
J.11.3.1.4.3
J.11.3.2.1.11
J.11.3.2.1.17
J.11.3.2.1.2
J.11.3.2.1.8
J.11.3.2.15.4
J.11.3.2.18.28
J.11.3.2.3.14
J.11.3.2.3.5
J.11.3.2.4.1
J.11.3.2.4.9
J.11.3.2.9.2
J.11.3.3.1.1
J.11.3.3.1.10
J.11.3.3.1.11
J.11.3.3.1.16
J.11.3.3.1.26
J.11.3.3.1.3
J.11.3.3.1.33
J.11.3.3.1.5
J.11.3.3.1.7
J.11.3.3.1.9
J.11.3.4.4.6.c

2.18.3 Instructions

All maps to be edgematched will be displayed together. Edgematched features will be highlighted or shown in color. It must be possible to redisplay the results of the edgematch, zoom in on any user specified area, and modify the location of the end nodes. It must be possible to display the maps with or without the map borders.

All coordinates are to be temporarily converted to a common coordinate system before edgematching.

The user must be able to specify search tolerances in map coordinates. There will be two tolerances. One tolerance, the **snap tolerance**, is will be the distance the lines will be moved to snap together, the second, the **inform tolerance**, is a larger tolerance to inform the user that a line on an adjoining map connects with the border and the distance between them is greater than the snap tolerance but not greater that the inform tolerance. (To snap means conditionally to collocate or superimpose one line onto another, depending upon their proximity to each other.) The default snap tolerance shall be 0.02 map inches. The default inform tolerance shall be 0.1 map inches.

The user must be able to specify the projection that the edgematching will be done in if more than one projection is involved.

Both interactive and automatic edgematching are to be available for features that meet the above criteria. In interactive edge-matching the user will be prompted to identify whether or not lines are to be snapped to the same border location. In automatic edgematching the system will use the point immediately preceding the intersection point at the map boundary. Only the line connector and mid-point options will be available under automated edge-matching.

These three methods of edgematching are to be available for use with any of the scripts. Each of the following examples occurs in Exhibit C-3.

a. Line connector option: A line is created and drawn between a user- specified point location and the edge of the map (see Example 1). A line segment is removed from Map B and the edge node is flagged for Map A and Map B.

b. Mid-point option: A line is created and drawn between two user- specified point locations (see Example 2). Line segments are deleted from Map A and Map B. A new node is created and flagged as an edge node for both maps.

c. Smooth option: A curved line is created and drawn between two user- specified point locations using a polynomial curve fitting algorithm (see Example 3). Line segments are deleted from Map A and Map B. A new node is created and flagged as an edge node for both maps.

Processing Environment

The following hardware shall be used for this FD:

HC-C	Color Hard Copy Unit on LAN C
PLE-C	Electrostatic Plotter on LAN C
WA-C	Advanced Workstation on LAN C

2.18.3.1 Script

This section contains specific instructions for completion of the FD.

2.18.3.1.1 Script for five 1:24000 scale maps with soils data in different projections and zones

a. Load all the files needed for the soils maps B743114, C643114, C743114, C843114, and D743114.

b. Display the soils data for the above maps. Make a hard copy on HC-C.

c. Prompt for the tolerances to be used.

d. Prompt for the projection to be used.

e. Edgematch all the lines that extend to the border of the five maps using the smooth option (3).

f. Create a temporary file containing the results of the edgematching.

g. Display and plot the results (at the same scale and in the same projection as the original maps) and identify by color or symbol those features that meet the tolerances for edgematching and those that are within the inform tolerance.

h. Demonstrate the capability to zoom in on any area and make any desired changes to the resultant maps.

i. Demonstrate that the proposed system requires the user to verify changes before they are permanently stored.

2.18.3.1.2 Script for four 1:100000 scale maps

a. Load all the files needed for the KIMCOM, LAJUNM, SPRNGM, and TWOBTM.

b. Display the line data for the above maps. Make a hard copy on HC-C.

c. Prompt for the tolerances to be used.

d. Edgematch all the lines that extend to the border of the four maps using the line-connector and the mid-point options (1 and 2).

e. Create a temporary file containing the results of the edgematching.

f. Display the results and identify by color or symbol those features that meet the tolerances for edgematching and those that are within the inform tolerance. Make a hard copy on HC-C.

g. Provide the option to zoom in on any area and make any desired changes to the resultant maps.

h. Demonstrate that the proposed system requires the user to verify changes before they are permanently stored.

2.18.3.1.3 **Script for one map at 1:62500 scale and three at 1:24000 scale**

a. Load all the files needed for the maps DLG1, DLG4, DLG5, and DLG7.

b. Display the land survey data for the above maps. Make a hard copy on HC-C.

c. Prompt for the tolerances to be used.

d. Edgematch all the lines that extend to the border of the four maps using the smooth option (3).

e. Create a temporary file containing the results of the edgematching.

f. Display the results and identify by color or symbol those features that meet the tolerances for edgematching and those that are within the inform tolerance. Make a hard copy on HC-C.

g. Provide the option to zoom in on any area and make any desired changes to the resultant maps.

h. Demonstrate that the proposed system requires the user to verify changes before they are permanently stored.

2.18.3.1.4 Script for two 1:100000 scale maps with more than 7500 lines each

a. Load all the files needed for the maps AD34117 and EH33117.

b. Display the soils data for the above maps. Make a hard copy on HC-C.

c. Prompt for the tolerances to be used.

d. Edgematch all the lines that extend to the border of the two maps using the smooth option (3).

e. Create a temporary file containing the results of the edgematching.

f. Display the results and identify by color or symbol those features that meet the tolerance for edgematching and those that are within the inform tolerance. Make a hard copy on HC-C.

g. Provide the option to zoom in on any area and make any desired changes to the resultant maps.

h. Demonstrate that the proposed system requires the user to verify changes before they are permanently stored.

2.18.3.1.5 Script for data crossing two state boundaries

a. Load all the files needed for the maps Idaho and Montana.

b. Display the data for the above maps. Make a hard copy on HC-C.

c. Prompt for the tolerances to be used.

d. Edgematch all the lines that extend to the border of the two maps using the smooth option (3).

e. Create a temporary file containing the results of the edgematching.

f. Display the results and identify by color or symbol those features that meet the tolerances for edgematching and those that are within the inform tolerance. Make a hard copy on HC-C.

g. Provide the option to zoom in on any area and make any desired changes to the resultant maps.

h. Demonstrate that the proposed system requires the user to verify changes before they are permanently stored.

2.18.3.2 Data

The data for the FD is supplied in Appendix D, Government Supplied Data. All files are in ADS format.

2.18.4 Expected Output

The output from the FD will be that features extending to the border of one map and continuing on the adjacent map will match at the borders of the maps.

2.18.5 Reserved

2.19 RESERVED

2.20 FD 20 - GIS OVERLAY

2.20.1 Objective

Demonstrate the capability of the proposed GIS to perform boolean overlay functions on complex vector data.

2.20.2 RFP References

C.3.6.2.1
J.11.3.2.1.15
J.11.3.2.4.11
J.11.3.2.15.3
J.11.3.2.16
J.11.3.2.25.8

2.20.3 Instructions

In this FD, a series of tests shall be performed. In each test, boolean overlay operations shall be performed between 2 vector maps. Some maps will have islands. Islands that are created shall be saved in the resultant maps. An overview of each of the tests is presented below. All plots and statistical results shall be based on the original map projection.

Each plot identified in the script shall be plotted using a scale of 1:24,000. The geographic window for the plot shall be the union of all the features of the 2 maps used in each individual test, unioned to a geographic window of (0,0) (lower left) to (30,000,30,000) (upper right).

The term 'subset' shall mean a subset of vector data identified by a substring within its attribute, e.g., subset 1 means there is a '1' somewhere in the attribute that is tied to that spatial feature.

All reports should be sorted in ascending order by attribute from the first map, then sorted by the attribute from the second map, then acres or length.

For the boolean NOT tests 'a NOT b' and 'b NOT a', the 'a' refers to the subset from the map with 'a' as the last character in the name and 'b' refers to the subset from the map with 'b' as the last character in the name.

For each test, concatenate the attributes so that the features in the resultant map have both attributes.

Test 1: Polygon Overlay With Void Islands

This test case consists of two bean shaped forms, each a mirror image of the other. Each bean is one layer in a two layer overlay problem. Each bean has two holes. The areas of the holes, and the area outside the shapes are void (no classification). The overlay functions required are intersection (AND), union (OR) (if possible with a removal of boundaries interior to any classification) and difference (AND NOT).

The objective is to test these overlay functions, and in particular, to see whether the situation with the holes will be resolved satisfactorily. Holes may require special handling in overlay programs. In this particular test case holes will be overlaid on top of other holes, and this may present a special problem. For the union function, the shape of the beans requires that new holes must be generated.

Another aspect of the test case (also for some of the other test cases), is a system's capability to handle void areas. Ideally, this is a special universe or background classification, but voids may also be characterized through the absence of any polygons or regions which would otherwise represent the void area.

Test 2: Multiple Island Overlay

This test case is similar to test case 1. Here the shapes are ovals rather than bean shapes. The objective for this case is to test a systems capability to handle multiple nested holes. In this case the holes are more properly referred to as islands or exclusion areas, because they ar not all void. Each outer polygon has a void exclusion area, which contains another polygon with another void exclusion area.

Test 3: Identical Polygon Overlay

The objective of this test case is to overlay two rectangles, one per layer, which are exactly identical in shape. For this purpose the rectangles are displayed on a grid, so that the coordinates may be read off, and precisely identical coordinates can be entered into the system for both rectangles. The outcome should be identical for the intersection (AND) and union (OR), but there should not be any output polygon whatsoever for the difference case

(AND NOT).

Overlaying identical shapes may represent special problems for a system because these situations represent borderline cases, which are usually dismissed when a system is first designed, where the programmers use of a 'greater than' instead of a 'greater than or equal' may well produce erroneous results.

Test 4: Identical Island Overlay

The idea for this test case is the same as used in test case 3, but here the identical shapes are irregular, and there are two types of islands, one a single void area and the second a void area containing another island. As with other test cases shown on a gridded background, great care should be taken to ensure that the coordinates in one layer are a precise copy of the coordinates in another layer. Perhaps if a system does not fail on the simple rectangles of test case 3, it may fail on this test case because special code may be invoked to handle the island and nested island situation.

Test 5: Tangent Island Overlay

One layer in this case is a simple rectangle, the other consists of a single triangle and a smaller rectangle. The triangle touches the larger rectangle at a single point and the smaller rectangle is coincident with the larger rectangle along its right hand side.

The triangle has been placed to test a systems capability to deal with so called "tangent islands." The situation can be resolved in two ways: the triangle can be made into an exclusion of the output polygon, or there can be two main output polygons. A similar situation occurs for the smaller rectangle. However, here a system should resolve the situation by producing two main output polygons: one the larger rectangle, and the other the smaller rectangle. It may be topologically correct to process the smaller rectangle as an island, but this results in a less desirable zero width corridor in the main output polygon. If the triangle is not processed as an exclusion area, the test case should produce three output polygons, otherwise it must produce two output polygons and an island.

The smaller rectangle also tests a systems capability for creating intersection points (nodes) for coincident lines. The right hand sides of the smaller and larger rectangles are coincident, and hence two nodes should be generated in the output layer for the two vertex points for the right side of the smaller rectangle, even though intersection points cannot be computed analytically, because the lines are coincident.

Test 6: Spiral Polygon Overlay

The subject of this test case is again voids and exclusion areas. One layer consists of a spiral, and a small rectangle forms the other layer. The background for the spiral and the small rectangle are void. The rectangle is placed so that for an intersection (AND) the background for the spiral is divided into two sections. One becomes a spiral void of a spiral polygon, the other becomes the void area around the general outline of the spiral.

Test 7: Coincident Lines Overlay

This test case was designed to test a system's capabilities to deal with coincident lines for the AND, OR and AND NOT operations, where two otherwise mutually exclusive shapes are coincident along a portion of their respective boundaries. The three-legged shape in one layer fits into a slot in the three- legged shape of the other layer. The result of the AND operations for this test case should be completely empty, whereas the AND NOT should return the first shape.

Test 8: Multiple Connecting Node Overlay

Many lines converging on a single node may produce processing problems. Each layer in this test case contains a rectangular shape with diagonals, such that 16 lines converge on a center node. The node is located in the same relative position for each layer, so that in the overlay there may be 32 lines converging on a single node. Moreover, the rectangle with diagonals in the second layer is mostly a duplicate of the rectangle in the first layer, with the exception of a smaller circumference, so that there will also be 16 coincident lines. This case is therefore yet another test for handling of coincident lines.

Test 9: Polygon Overlay With Offset Multiple Connecting Node

The figures in this test case are entirely the same as in the previous one. However, the second rectangle has been displaced by one gridcell. This should assess a system's capability to deal with nearly coincident lines, where the lines all converge to an approximately identical location. Do not delete boundaries interior to a classification.

A number of slivers should result. Nearly coincident lines should be snapped to a single line according to a user specified tolerance of 10 meters.

Test 10: Overlay Tolerance Variations

The two shapes in both layers are identical. The second shape has been offset downwards and to the right by half a gridcell width. The user selected tolerance should be set to a value which is slightly less than one gridcell dimension. This will insure that the tolerance will be greater than the distance between the nearly coincident lines which is one-half gridcell width.

Test 11: Line On Polygons Overlay

When a system has a capability to overlay lines on polygons, dilemmas may arise when a line is exactly coincident with the border between two polygons. This test case simulates this situation. Report the lines in both areas, in one area or in neither area.

Test 12: Points On Polygons Overlay

The idea here is similar to the one of test case 11, but points are used instead of lines. Some points are on the boundary between the two rectangles of the first layer, others are completely in the interior, and yet others are on the external boundaries. Report points coincident with the boundary in areas to the north and to the west of the boundary. Report points on a south or east boundary.

Test 13: Attribute Handling In Overlay

Test case 13 consists of two irregular polygons in the first layer with attributes a and b respectively, and two irregular polygons in the other layer with a main division at a right angle to the main division in the first layer. The two polygons in the second layer have properties c and d respectively. The test case requests an intersection between the two sets of two polygons, and the expected result is four polygons with attribute combinations ac, ad, bc, and bd. The objective of the test is to report these results with a minimum of user intervention. Demonstrate that the attribute combinations are correctly assigned to the output polygons.

Test 14: Aggregation Attribute Handling

If the two layers in the previous test case are thought of as soils and vegetation, the a and b may be vegetation types, and c and d can be soil types. The various combinations ac, ad, etc. then represent combined soils and vegetation types. In test case 14, the objective is to take the results of test case 13 and perform a union with a deletion of interior boundaries between properties c and d. Report the resultant attributes type. The two vegetation types can be considered as multiple values for the attribute vegetation. Hence test case 14 is used to assess a system's capability for dealing with the multiple value problem. At the same time it tests capabilities for using previously generated outputs as inputs for subsequent queries.

Test cases 13 and 14 combined will reveal the extent to which initial attributes can be carried through a series of mixed operations, and still be reported on in a final report and map. They will also show the extent to which user intervention is required to produce this result.

Processing Environment

The following hardware shall be used for this FD:

PLP-C	Pen Plotter on LAN C
PSW-C	Serial Printer Wide on LAN C
WB-C	Basic Workstation on LAN C

2.20.3.1 Script

The following tests shall be performed using the files supplied.

For each test, read the input files into the proposed GIS, then perform the steps specified.

2.20.3.1.1 Script for Test 1

a. From map TC01A select subset 1.

b. From map TC01B select subset 1.

c. Perform a boolean intersection between the 2 subsets.

d. Plot the resultant map, shading the intersections.

e. Report the acreage for each polygon in map TC01A and TC01B.

f. Report the acreage for each polygon in the resultant map.

g. Perform a boolean union between the 2 subsets.

h. Plot the resultant map, shading the union.

i. Report the acreage for each polygon in the resultant map.

j. Perform a boolean a NOT b operation between the 2 subsets.

k. Plot the resultant map, shading the resulting polygons.

l. Report the acreage for each polygon in the resultant map.

m. Perform a boolean b NOT a operation between the 2 subsets.

n. Plot the resultant map, shading the resulting polygons.

o. Report the acreage for each polygon in the resultant map.

2.20.3.1.2 Script for Test 2

a. From map TC02A select subset 1.

b. From map TC02B select subset 1.

c. Perform a boolean intersection between the 2 subsets.

d. Plot the resultant map, shading the intersections.

e. Report the acreage for each polygon in map TC02A and TC02B.

f. Report the acreage for each polygon in the resultant map.

g. Perform a boolean union between the 2 subsets.

h. Plot the resultant map, shading the union.

i. Report the acreage for each polygon in the resultant map.

j. Perform a boolean a NOT b operation between the 2 subsets.

k. Plot the resultant map, shading the resulting polygons.

l. Report the acreage for each polygon in the resultant map.

m. Perform a boolean b NOT a operation between the 2 subsets.

n. Plot the resultant map, shading the resulting polygons.

o. Report the acreage for each polygon in the resultant map.

2.20.3.1.3 Script for Test 3

a. From map TC03A select subset 1.

b. From map TC03B select subset 1.

c. Perform a boolean intersection between the 2 subsets.

d. Plot the resultant map, shading the intersections.

e. Report the acreage for each polygon in map TC03A and TC03B.

f. Report the acreage for each polygon in the resultant map.

g. Perform a boolean union between the 2 subsets.

h. Plot the resultant map, shading the union.

i. Report the acreage for each polygon the in resultant map.

j. Perform a boolean a NOT b operation between the 2 subsets.

k. Plot the resultant map, shading the resulting polygons.

l. Report the acreage for each polygon in the resultant map.

m. Perform a boolean b NOT a operation between the 2 subsets.

n. Plot the resultant map, shading the resulting polygons.

o. Report the acreage for each polygon in the resultant map.

2.20.3.1.4 Script for Test 4

a. From map TC04A select subset 1.

b. From map TC04B select subset 1.

c. Perform a boolean intersection between the 2 subsets.

d. Plot the resultant map, shading the intersections.

e. Report the acreage for each polygon in map TC04A and TC04B.

f. Report the acreage for each polygon in the resultant map.

g. Perform a boolean union between the 2 subsets.

h. Plot the resultant map, shading the union.

i. Report the acreage for each polygon the resultant map.

j. Perform a boolean a NOT b operation between the 2 subsets.

k. Plot the resultant map, shading the resulting polygons.

l. Report the acreage for each polygon in the resultant map.

m. Perform a boolean b NOT a operation between the 2 subsets.

n. Plot the resultant map, shading the resulting polygons.

o. Report the acreage for each polygon in the resultant map.

2.20.3.1.5 Script for Test 5

a. From map TC05A select subset 1.

b. From map TC05B select subset 1.

c. Perform a boolean intersection between the 2 subsets.

d. Plot the resultant map, shading the intersections.

e. Report the acreage for each polygon in map TC05A and TC05B.

f. Report the acreage for each polygon in the resultant map.

g. Perform a boolean union between the 2 subsets.

h. Plot the resultant map, shading the union.

i. Report the acreage for each polygon the resultant map.

j. Perform a boolean a NOT b operation between the 2 subsets.

k. Plot the resultant map, shading the resulting polygons.

l. Report the acreage for each polygon in the resultant map.

m. Perform a boolean b NOT a operation between the 2 subsets.

n. Plot the resultant map, shading the resulting polygons.

o. Report the acreage for each polygon in the resultant map.

2.20.3.1.6 **Script for Test 6**

a. From map TC06A select subset 1.

b. From map TC06B select subset 1.

c. Perform a boolean intersection between the 2 subsets.

d. Plot the resultant map, shading the intersections.

e. Report the acreage for each polygon in map TC06A and TC06B.

f. Report the acreage for each polygon in the resultant map.

g. Perform a boolean union between the 2 subsets.

h. Plot the resultant map, shading the union.

i. Report the acreage for each polygon in the resultant map.

j. Perform a boolean a NOT b operation between the 2 subsets.

k. Plot the resultant map, shading the resulting polygons.

l. Report the acreage for each polygon in the resultant map.

m. Perform a boolean b NOT a operation between the 2 subsets.

n. Plot the resultant map, shading the resulting polygons.

o. Report the acreage for each polygon in the resultant map.

2.20.3.1.7 Script for Test 7

a. From map TC07A select subset 1.

b. From map TC07B select subset 1.

c. Perform a boolean intersection between the 2 subsets.

d. Plot the resultant map, shading the intersections.

e. Report the acreage for each polygon in map TC07A and TC07B.

f. Report the acreage for each polygon in the resultant map.

g. Perform a boolean union between the 2 subsets.

h. Plot the resultant map, shading the union.

i. Report the acreage for each polygon in the resultant map.

j. Perform a boolean a NOT b operation between the 2 subsets.

k. Plot the resultant map, shading the resulting polygons.

l. Report the acreage for each polygon in the resultant map.

m. Perform a boolean b NOT a operation between the 2 subsets.

n. Plot the resultant map, shading the resulting polygons.

o. Report the acreage for each polygon in the resultant map.

2.20.3.1.8 Script for Test 8

a. From map TC08A select subset 1.

b. From map TC08B select subset 1.

c. Perform a boolean intersection between the 2 subsets.

d. Plot the resultant map, shading the intersections.

e. Report the acreage for each polygon in map TC08A and TC08B.

f. Report the acreage for each polygon in the resultant map.

g. Perform a boolean union between the 2 subsets.

h. Plot the resultant map, shading the union.

i. Report the acreage for each polygon in the resultant map.

j. Perform a boolean a NOT b operation between the 2 subsets.

k. Plot the resultant map, shading the resulting polygons.

l. Report the acreage for each polygon in the resultant map.

m. Perform a boolean b NOT a operation between the 2 subsets.

n. Plot the resultant map, shading the resulting polygons.

o. Report the acreage for each polygon in the resultant map.

2.20.3.1.9 Script for Test 9

a. From map tc9a select subset 1.

b. From map TC09B select subset 1.

c. Perform a boolean intersection between the 2 subsets.

d. Plot the resultant map, shading the intersections.

e. Report the acreage for each polygon in map tc9a and TC09B.

f. Report the acreage for each polygon in the resultant map.

g. Perform a boolean union between the 2 subsets.

h. Plot the resultant map, shading the union.

i. Report the acreage for each polygon in the resultant map.

j. Perform a boolean a NOT b operation between the 2 subsets.

k. Plot the resultant map, shading the resulting polygons.

l. Report the acreage for each polygon in the resultant map.

m. Perform a boolean b NOT a operation between the 2 subsets.

n. Plot the resultant map, shading the resulting polygons.

o. Report the acreage for each polygon in the resultant map.

2.20.3.1.10 Script for Test 10

a. From map TC10a select subset 1.

b. From map TC10b select subset 1.

c. Perform a boolean intersection between the 2 subsets.

d. Plot the resultant map, shading the intersections.

e. Report the acreage for each polygon in map TC10a and TC10b.

f. Report the acreage for each polygon in the resultant map.

g. Perform a boolean union between the 2 subsets. Plot the resultant map, shading the union.

h. Report the acreage for each polygon in the resultant map.

i. Perform a boolean a NOT b operation between the 2 subsets.

j. Plot the resultant map, shading the resulting polygons.

k. Report the acreage for each polygon in the resultant map.

l. Perform a boolean b NOT a operation between the 2 subsets.

m. Plot the resultant map, shading the resulting polygons.

n. Report the acreage for each polygon in the resultant map.

2.20.3.1.11 Script for Test 11

a. From map TC11a select all.

b. From map TC11b select all.

c. Perform a boolean intersection between the 2 maps.

d. Plot the resultant line map.

e. Report the acreage for each polygon in map TC11a, and length for each line TC11b, and the length for each line in resultant map.

2.20.3.1.12 Script for Test 12

a. From map TC12a select all.

b. From map TC12b select all.

c. Perform a boolean intersection between the 2 maps.

d. Plot the resultant point map, labelling all attributes assigned to each point.

e. Report the acreage for each polygon in map TC12a. List the attributes for TC12b and the resultant map.

2.20.3.1.13 **Script for Test 13**

a. From map TC13a select subset 1 and 2.

b. From map TC13b select subset 1 and 2.

c. Perform a boolean intersection between the 2 subsets.

d. Plot the resultant map, shading the intersections, using different patterns for each unique attribute. Plot the attribute totally within each resultant polygon.

e. Report the acreage for each polygon in map TC13a, TC13b, and the resultant map.

2.20.3.1.14 **Script for Test 14**

a. From map TC14A select all.

b. Remove any common boundary between polygons with 1 or 2 somewhere in their attributes.

c. Plot the resultant map, shading the intersections.

d. Report the acreage for each polygon in the test13 resultant map and the test 14 resultant map.

2.20.3.2 **Data**

The maps for this FD all have tc as a prefix and either a or b as a suffix. Between the prefix and suffix is a number that corresponds to the specific test. The data for this FD is supplied in Appendix D, Government Supplied Data.

2.20.3.3 **Reserved**

2.20.4 Expected Output

Each report shall be structured as follows:

column 1 - 10	map 1 attribute	as alpha
column 11 - 21	map 2 attribute	as alpha
column 21 - 35	area or length	report to 3 decimal places

Numeric columns shall be right justified without trailing blanks. Alpha columns shall be left justified without leading blanks.

2.20.5 Reserved

2.21 FD 21 - GIS OVERLAY VOLUME CAPACITY

2.21.1 Objective

Demonstrate the capability of the proposed GIS to do boolean overlay functions on large volumes of data.

2.21.2 RFP References

J.11.3.2.1.15
J.11.3.2.4.11
J.11.3.2.15.3
J.11.3.2.16.1
J.11.3.2.25.8

2.21.3 Instructions

In this FD, boolean overlay operations shall be performed on 2 vector maps. One map will have multiple attributes. One map will have islands. Islands that are created shall be saved in the resultant maps. All plots and statistical results shall be based on the original map projection.

Script 2.21.3.1.1 shall be performed on an advanced workstation. Script 2.21.3.1.2 through 2.21.3.1.4 may be performed either on the workstation or the multi-user processor.

Processing Environment

The following hardware shall be used for this FD:

MPA-A	Multi-user Processor - Class A on LAN A
PLE-C	Electrostatic Plotter on LAN C
PSW-C	Serial Printer Wide on LAN C
WA-C	Advanced Workstation on LAN C

2.21.3.1 Script

2.21.3.1.1 Script for Setup

a. Read the files PHYSIO_USA, COUNTY_USA, and COUNTY_USA.AT into the proposed GIS.

b. Restructure PHYSIO_USA to correctly store islands. The paper map of the vegetation of the USA (Potential Natural Vegetation of the U.S., by A.W. Kuchler, 1973, American Geographic Society, Broadway at 156th Street, New York, N.Y. 10032) shall be the only reference for assigning values to polygons and islands.

c. Report the total number of polygons, total acres, and total number of islands in PHYSIO_USA.

d. Produce a Polygon Report showing the total acres in each vegetative type in PHYSIO_USA, sorted in ascending order by province ID (subject).

e. Produce a Polygon Report showing the acres, perimeter, and number of coordinates in each polygon in PHYSIO_USA, sorted in ascending ID (subject) order, then in ascending acres order.

f. Plot the PHYSIO_USA map at a scale of 1:3,168,000. Polygon IDs (subject) shall be plotted in each polygon.

g. Report the total number of polygons, total acres, and total number of islands in COUNTY_USA

h. Produce a Polygon Report showing the total acres in each county in COUNTY_USA, sorted in ascending order by state then by county.

i. Produce a Polygon Report showing the acres, perimeter, and number of coordinates in each polygon in COUNTY_USA, sorted in ascending state order, then in ascending county order, then in ascending acres order.

j. Plot the COUNTY_USA map at a scale of 1:3,168,000. State and county should be plotted in each polygon with state on top. The lower left location for the state label should match the x,y location in the MOSS map.

2.21.3.1.2 Script for Intersection

a. Perform a boolean AND operation (intersection) between the 2 maps, creating a new map called INTERSECTION.MAP. Capture performance metrics and produce a Performance Report on the AND operation.

b. Report the total number of polygons, total acres, and total number of islands in INTERSECTION.MAP.

c. Produce a Polygon Report showing the acres, perimeter, and number of coordinates in each polygon in INTERSECTION.MAP, sorted in ascending state order, then in ascending county order, then in vegetative type order, then in ascending acres order.

d. Plot INTERSECTION.MAP at a scale of 1:3,168,000. Plot state, county and vegetative type in each polygon, state on top, then county.

2.21.3.1.3 Script for Union

a. Perform a boolean OR operation (union) between the COUNTY_USA map and the largest province type from the PHYSIO_USA map, i.e., the province type with the greatest total acres. Call the result UNION.MAP. Capture performance metrics and produce a Performance Report on the OR operation.

b. Report the total number of polygons, total acres, and total number of islands in UNION.MAP.

c. Produce a Polygon Report showing the acres, perimeter, and number of coordinates in each polygon in UNION.MAP, sorted in ascending state order, then in ascending county order, then in vegetative type order, then in ascending acres order.

d. Plot UNION.MAP at a scale of 1:3,168,000. Plot state, county and vegetative type in each polygon, with state on top, then county.

2.21.3.1.4 Script for Difference

a. Perform a boolean NOT operation between COUNTY_USA and PHYSIO_USA, such that a new map PHYSIO.NOT.COUNTY contains all the areas that are in the PHYSIO_USA map and are not "covered" by county polygons in the COUNTY_USA map. Capture performance metrics and produce a Performance Report on the NOT operation.

b. Report the total number of polygons, total acres, and total number of islands in PHYSIO.NOT.COUNTY.

c. Produce a Polygon Report showing the acres, perimeter, and number of coordinates in each polygon in PHYSIO.NOT.COUNTY, sorted in ascending state order, then in ascending county order, then in vegetative type order, then in ascending acres order.

d. Plot PHYSIO.NOT.COUNTY at a scale of 1:3,168,000. Plot state, county and vegetative type in each polygon, state on top, then county.

e. Perform a boolean NOT operation between COUNTY_USA and PHYSIO_USA, such that a new map COUNTY.NOT.PHYSIO contains all the areas that are in the COUNTY_USA map and are not covered by polygons in PHYSIO_USA. Capture performance metrics and produce a Performance Report on the NOT operation.

f. Report the total number of polygons, total acres, and total number of islands in COUNTY.NOT.PHYSIO.

g. Produce a Polygon Report showing the acres, perimeter, and number of coordinates in each polygon in COUNTY.NOT.PHYSIO, sorted in ascending state order, then in ascending county order, then in vegetative type order, then in ascending acres order.

h. Plot COUNTY.NOT.PHYSIO at a scale of 1:3,168,000. Plot state, county and vegetative type in each polygon, state on top, then county.

2.21.3.2 Data

PHYSIO_USA is a map of the potential natural vegetation of the US. It is in MOSS vector format, polygon structure. It has NOT been topologically structured to identify islands.

COUNTY_USA is a map of the counties for each state in the US. It is in MOSS vector format, polygon structure. It has a multiple attribute table.

COUNTY_USA.AT is a file of attributes associated with the features in COUNTY_USA.

2.21.3.3 Reserved

2.21.4 Expected Output

The output from this demonstration includes printed and plotted results as specified in the script.

The following two formats shall be used for the various reports specified in the script. Unnecessary fields may be left blank in those reports which do not require the use of all the fields in a format, e.g., reports totalling acreage. Alpha fields ("A" in the "A/N" column) shall be left-justified with trailing blanks. Numeric fields ("N" in the "A/N" column) shall contain right-justified integers with leading zeroes.

2.21.4.1 Polygon Report Format

Polygon Reports describing sets of polygons shall be in the following format:

Start Position	End Position	Field Name	A/N	Description
1	10	StateID	A	State Identifier
11	20	CountyID	A	County Identifier
21	30	ProvID	N	Province Identifier
31	45	Acreage	N	Acreage in Whole Acres
46	60	Perimeter	N	Perimeter
61	80	Coordinates	N	Number of Coordinates

2.21.4.2 Performance Metrics Report Format

Performance Reports recording performance metrics shall be in the following format:

Start Position	End Position	Field Name	A/N	Description
1	1	Step	N	Step Number
2	23	Filler		
24	26	ElapseSSS	N	Elapsed Time: Seconds
27	30	ElapseTTTT	N	Elapsed Time: Tenthousandths
31	33	TotCPUSec	N	Total CPU Time: Seconds
34	37	TotCPUTT	N	Total CPU Time: Tenthousandths
38	40	CPUSec1	N	1st CPU Time: Seconds
41	44	CPUTT1	N	1st CPU Time: Tenthousandths
45	47	CPUSec2	N	2nd CPU Time: Seconds[1]
48	51	CPUTT2	N	2nd CPU Time: Tenthousandths1
52	56	TotDIO	N	Tot Dir I/O Count for All Devices
57	60	DIO1	N	Dir I/O Count for First Device
61	64	DIO2	N	Dir I/O Count for Second Device1[1]
65	68	DIO3	N	Dir I/O Count for Third Device1[1]
69	72	DIO4	N	Dir I/O Count for Fourth Device1[1]
73	77	TotBIO	N	Tot Buff I/O Count for All Devices

---

[1] For use only if necessary

Start Position	End Position	Field Name	A/N	Description
78	81	BIO1	N	Buff I/O Count for First Device
82	85	BIO2	N	Buff I/O Count for Second Device1[1]
86	89	BIO3	N	Buff I/O Count for Third Device1[1]
90	93	BIO4	N	Buff I/O Count for Fourth Device1[1]
94	100	PgFaults	N	Number of Page Faults

2.21.5 **Reserved**

---

[1] For use only if necessary

2.22 FD 22 - GIS UPDATE

2.22.1 Objective

Demonstrate the capability of the proposed GIS to modify existing features (points, lines, and polygons) and attributes and add features and attributes to an existing spatial data base, performing topological restructuring.

2.22.2 RFP References

C.3.6.2
C.3.6.4.2
C.4.3
J.11.2.14
J.11.2.16.1
J.11.3.1.1.6
J.11.3.1.2.1
J.11.3.1.2.3
J.11.3.2.1
J.11.3.2.2.3
J.11.3.2.2.5
J.11.3.2.3
J.11.3.2.3.4
J.11.3.2.5
J.11.3.2.5.5
J.11.3.2.8
J.11.3.2.13
J.11.3.2.14.16
J.11.3.2.16
J.11.3.2.18
J.11.3.2.18.1
J.11.3.2.18.15
J.11.3.2.18.20
J.11.3.2.19.1
J.11.3.3.1
J.11.3.3.1.14
J.11.3.3.2.9
J.11.3.3.2.8
J.11.3.4.5.5

2.22.3 Instructions

In this FD, data items will be added to an existing data set supplied by the Government. One map with multiple layers of data will be updated. Data for this map will be captured from sources consisting of three different scales; 1:24000, 1:62,500, and 1:100,000.

Definition of terms:

CURSOR:	An input device connected to a digitizing tablet used to define data points by pressing a button at each vector on a line or data point location.
SNAP:	Conditional automatic colocation or superimposition of a data point onto another existing data point.
SPARK:	Defining a data point by pressing a button on a digitizing cursor.
BASE POINT:	A user identified point of reference to be used when relocating data from one location (base point) to another (destination point).

Processing Environment

The following hardware shall be used for this FD:

DL-C	Large Digitizer on LAN C
PLE-C	Electrostatic Plotter on LAN C
PLP-C	Pen Plotter on LAN C
PSW-C	Serial Printer Wide on LAN C
WB-C	Basic Workstation on LAN C

2.22.3.1 Script

2.22.3.1.1 Script for Map Registration

a. On a digitizing tablet, register the supplied 1:24,000 scale map (Crow Mesa West, NM) using the erroneous points which will be identified (marked on the map).

b. Calculate and report the predicted scale.

c. Input the actual scale.

d. Report the registration error.

e. Re-register the map using the proper registration points which will be identified.

f. Calculate and report the predicted scale

g. Input the actual scale.

h. Report the registration error.

2.22.3.1.2 Script for Digitization

a. Capture the highlighted lines, classifying the line types (UNIMPROVED DIRT ROAD, LIGHT-DUTY ROAD, MEDIUM DUTY ROAD) and assigning the appropriate identifier (highway number or other number which will be annotated on the source map) to each of the data items as they are captured.

b. Adjust snapping tolerance to 0.25 inches. While digitizing line #2, demonstrate that snapping will not occur beyond specified tolerance by sparking point S1. Snap line #2 to line #1 by sparking point S2.

c. Digitize the prescribed lines onto the 1:100,000 scale map of the same area.

d. Digitize the prescribed lines onto the 1:62,500 scale map of the same area.

e. Create a title, legend, barscale, and a block of text as shown in the example.

f. Plot the results on PLP-C at its finest resolution.

2.22.3.1.3 Script for Direct Coordinate Input

a. Using the supplied data, interactively input coordinates of Lat/Long, UTM meters, and State Plane feet to create the specified lines, and locate the specified symbols and text.

b. Plot the results on PLP-C at its finest resolution at a scale of 1:24,000.

2.22.3.1.4 Script for Topological Structuring

a. Construct polygons from existing freeform lines (Public Land Survey) and assign attributes to polygons in an automated fashion.

b. Process polygons with multiple and nested islands to demonstrate proper polygon island handling via area report. Land Ownership data in ADS format is supplied in Appendix D.

c. Join three existing lines (L1, L2, L3) end to end to form one ordered line.

d. Split a selected line (L5) at prescribed points into three lines.

e. Assign shading to the specified Ownership polygons (P1, P2, P3) interactively through on-screen crosshair selection.

f. Assign shading to Ownership polygons through attribute classification (the angles for shading are 0=public, 45=private, 90=state, 45 crosshatched=indian).

g. Plot the results on PLE-C at a scale of 1:24,000.

2.22.3.1.5 Script for Symbol Modification

a. Pick individually by a point defined by the user, a selected group of symbols (highlighted on the source map) to be moved as a group from one user identified point to another.

b. Snap to symbol labeled S1 when defining the base point.

c. Perform the data movement by locating the defined base point to location labeled S2.

d. Select the same group of symbols and perform the data movement by locating the defined base point to an absolute location specification (lat/long, UTM, or State Plane feet to be specified at the time of the test).

e. Select the same group of symbols and perform the data movement by relocating the defined basepoint relative to (x and y offset, feet meters or miles to be specified at the time of the test) an existing or defined point.

f. Select the same group of symbols and perform the data movement by snapping the defined base point to an existing data point.

g. Delete the same group of symbols

h. Modify the label (attribute) on symbol S5 to read "Kerr- MacIntosh IJ22G."

i. Duplicate symbols S15 through S20 onto a layer (theme) named "UPPER LAYER WELLS."

j. Plot the results on PLE-C at a scale of 1:24,000.

k. Restore the symbols which were deleted.

l. Plot the results on PLE-C at a scale of 1:24,000.

2.22.3.1.6 Script for Line Modification

a. Pick individually by a point defined by the user, a selected group of points on a line (highlighted on the source map) to be moved as a group from one user identified point to another.

b. Perform the data movement by locating the defined base point to a user defined point.

c. Perform the data movement by locating the defined base point to an absolute location specification (lat/long, UTM, and State Plane feet),

d. Perform the data movement by locating the defined base point relative to (x and y offset) an existing or defined point.

e. Perform the data movement by snapping the defined base point to an existing data point.

f. Delete the selected points from line L3 to "straighten" the line.

g. Add the prescribed points to line L4 so it follow the line on the "streams" layer.

h. Modify the label (attribute) on line L5 to read "Class 4 Road."

i. Duplicate lines L15 through L20 onto a layer (theme) named "CONSTRUCTION."

j. Plot the results on PLE-C at a scale of 1:24,000.

2.22.3.2 Data

All data supplied for this demonstration occurs in Appendix D, Government Supplied Data.

2.22.3.3 Programs

U.S.G.S. Projection package or an equivalent package may be used for coordinate translation.

2.22.4 Expected Output

The output of this demonstration shall include an updated DLG and a hard copy output at 1:24,000 scale on mylar for verification.

The output shall include an indication of the error resulting from both the erroneous and the proper registration of the map Crow Mesa West, NM. An error of 100 ft. is expected from the erroneous registration. Less than 24 ft. of error is expected from the proper registration.

The output shall include plotted output of the data (at the actual scale of the source). The output of all digitized lines will be expected to fall within 0.01 inches of the source.

2.22.5 Reserved

2.23 FD 23 - GIS FEATURE TO GRID INTERPOLATION & CONTOURING

2.23.1 Objective

Demonstrate the capability of the proposed system to: (a) interpolate cell or raster datasets from randomly or regularly distributed points which have numeric attributes without and with fault barriers; (b) generate contour/isoline vector data from the raster interpolated data; (c) smooth the contour/isoline to vector data; (d) on-line edit (e.g., move, delete, add new elevations) the contour/isoline data and refresh and redraw the contour/isoline data; and (e) interpolate cell or raster datasets from numerically attributed contour/isoline vector data.

2.23.2 RFP References

J.11.3.2.14.3
J.11.3.2.14.9
J.11.3.2.14.12
J.11.3.2.14.13
J.11.3.2.14.15
J.11.3.2.14.19

2.23.3 Instructions

In this FD, raster datasets shall be created from a point dataset using several different interpolation algorithms. These algorithms include inverse distance, kriging, minimum curvature and quintic spline. The raster datasets shall then be created a second time using a fault barrier. The resultant raster data set (grid) shall then be used to create a line dataset (contour map), and in turn, this line dataset (contour map) shall go through a process to smooth out the contour lines to remove any jagged, angular lines. The smoothed contour map shall then be edited (i.e., move, delete, generate and reconstruct contour lines) and after editing, the screen shall automatically refresh and redraw the edited contour map. Finally, a raster dataset (grid) shall be created from this line dataset (contour map) by interpolating continuous values between the numeric values of the lines.

Processing Environment

The following hardware shall be used for this FD:

HC-C	Color Hard Copy Unit on LAN C
PLE-C	Electrostatic Plotter on LAN C
PLP-C	Pen Plotter on LAN C
PSW-C	Serial Printer Wide on LAN C
WA-C	Advanced Workstation on LAN C

2.23.3.1 Script

2.23.3.1.1 Script for Objective (a)

a. Read the elevation point-data file D_SD_FLAT.DAT into the proposed system.

b. Create a total of four raster datasets, one each by interpolating the point data in D_SD_FLAT.DAT using inverse distance squared, kriging, minimum curvature, and quintic spline interpolation algorithms. Each raster dataset shall be an array of approximately 89 cells in the X direction and approximately 152 cells in the Y direction or be composed of approximately square 5-acre cells. The datasets shall encompass the following Universal Transverse Mercator Zone 13 coordinates: XMIN = 589188.1 Meters, XMAX = 601848.1 Meters, YMIN = 4485056 Meters, YMAX = 4506677 Meters. A search radius of 23086 Meters shall be used where applicable. A normal search method utilizing the 10 nearest points shall be used where applicable.

c. Display each raster dataset to the screen by shading, hatching as solid color flooding to distinguish cells in the following ranges:

    Less than 10
    10 to 15
    15 to 20
    20 to 25
    25 to 30
    30 to 35
    35 to 40
    40 to 45
    45 to 50
    Greater than 50

    Print a color hard copy of each raster data set on HC-C.

d. Read both the elevation point-data file D_SD_FLAT.DAT used in Step 1 and a fault line dataset FAULT.EX into the proposed system. Both these files are in the same geographic area.

e. Repeat Step 2 using the elevation point-data file and the fault line file. The fault lines shall act as barriers to interpolation of cell values across the barriers.

2.23.3.1.2 Script for Objective (b)

a. Create a line dataset (contour map) from each of the eight raster datasets (grids) created in Objective (a). Four grids are without the fault lines and 4 grids are with the fault lines. The contours shall range in value from 10 to 50. The contour interval shall be 5. The original data points shall be plotted on the map using plus (+) symbols and shall be labeled with their elevation values. The contours shall be labeled with their values sufficient to determine the values of any unlabeled contours. The four borders of the maps shall be labeled with tick marks and coordinate values every 1000 meters. The maps shall be plotted on 8-1/2 " by 11 " plain white paper and shall be titled with the interpolation algorithm used. All labels shall be sized to maximize readability and minimize overprinting. Map scale shall be approximately 1:90,909 for kriging, minimum curvature and inverse distance squared and approximately 1:101,376 for quintic spline. Inverse distance squared and quintic spline must honor the original data points. For the grids with the fault lines, also show the fault lines on the printed maps.

Plot each of the four maps. Figures 1 through 6 in the Expected Output section below are examples of the type of output expected from this step.

2.23.3.1.3 Script for Objective (c)

a. For each line (contour) map created in Objective (b), use a smoothing routine that performs an interpolation of the line map and produces a line map with smoothed lines. Figure 7 is an example of a map before smoothing.

b. Plot each of the new line datasets as instructed in Objective (b), Step 1. Figure 8 is an example.

2.23.3.1.4 Script for Objective (d)

a. Using crosshairs, a mouse or similar method and using one of the contour maps created above, (a) move several contour lines over to a position that is to the left or right of their current positions; (b) find a looped contour line (i.e., a line that turns and parallels the first part of line) in contour map and use edit capabilities to reconstruct the looped contour line to a closed circular line (i.e., a closure) where the line turns and then connect the remaining ends of the bottom part of the contour line to make it continuous; (c) delete several contour lines from the map; (d) reconstruct two closely located circular contour lines (closures) to make a singular closure; and (e) create a new contour line. Figure 9 is an example of a map before editing.

b. When all editing is completed, have the screen automatically refresh and redraw the edited contour map. Figure 10 is an example.

c. Edits shall also edit the underlying grid. Plot the grid to show that the changes have been made also in the grid.

d. Plot the edited contour maps on PLE-C at a scale of 1:24,000.

2.23.3.1.5 Script for Objective (e)

a. Read the file CARCYN.EX into the proposed system.

b. Create a raster dataset from the numerically attributed line dataset in CARCYN.EX by interpolating the cell values between the lines.

c. Create a line dataset (contour map) from the raster dataset created in Step 2. The contour interval shall be 30 meters.

d. Read the file CARRACAS.CANYON into the proposed system.

e. Compare CARRACAS.CANYON with the raster dataset created in Step 2 by totaling the absolute values of the differences between the cells of the two raster datasets. Display the resulting raster dataset on the screen and make a hard copy of it on HC-C. Make a textual table of the results in the same format as the example in Exhibit C-2, Example of Raster Comparison. Output it as an ASCII file named RASTER.COMPARISON.

f. Analyze the output data and print a report to show that 91 percent of the absolute values of the differences are from 0 to 10 meters, 4 percent are from 11 to 20 meters, and not more than 5 percent are greater than 20 meters. Also, values greater than 20 meters shall be only found at the edges of the resultant raster dataset.

g. Plot CARRACAS.CANYON and the raster dataset created in Step 2 as instructed in Objective (b), Step 1.

2.23.3.2 **Data**

The data for this FD is supplied in Appendix D, Government Supplied Data.

2.23.3.3 **Programs**

References pertaining to the required interpolation algorithms follow:

Kriging:

Clark, Isobel. 1979. Practical Geostatistics. Applied Science Publishers, London. 150pp.

Journal, A.G. and Huijbregts,Ch.J. 1978. Mining Geostatistics. Academic Press, New York. 600pp.

Knudsen, H.P. and Kim, Y.C. 1977. A Short Course on Geostatistical Ore Reserve Estimation. College of Mines, University of Arizona, Tucson, Arizona. 202pp.

Quintic Spline:

Akima, Hiroshi. 1978. "Bivariate Interpolation and Smooth Surface Fitting of Irregularly Distributed Data Points." No. 526 in Collected Algorithms of the ACM.

Akima, Hiroshi. 1978. "A Methods of Bivariate Interpolation and Smooth Surface Fitting for Irregularly Distributed Data Points." ACM Trans. Math. Software 4,2. pp.148-159.

Minimum Curvature:

Briggs, Ian C., 1974, Machine Contouring Using Minimum Curvature: Geophysics, V.39 pp. 39-47.

The formula used for Inverse Distance Squared is:

$$Z = \frac{\sum_{i=1}^{n} Z_i/(d_i)^2}{\sum_{i=1}^{n} 1/(d_i)^2}$$

where Z_i is a neighboring point,
where d is distance,and,
where n is the number of Z elements

2.23.4 Expected Output

The expected output shall resemble the figures in Exhibit C-4 and are as follows:

Figures 1 and 5: Output resulting from the Kriging algorithm.

Figure 2: Output resulting from the Inverse Distance Squared algorithm.

Figure 3: Output resulting from the Minimum Curvature algorithm.

Figure 4: Output resulting from the Quintic Spline algorithm.

Figure 6: Generated contour map where there are fault barriers. The contour lines in the example fall short of the fault line with the current system; in the proposed system the contour lines should end at fault line.

Figure 7:	Contour maps before angular lines have smoothed by a smoothing routine.
Figure 8:	Contour map after angular lines have been smoothed by a smoothing routine.
Figure 9:	Contour map before editing.
Figure 10:	Edited contour map in which contour lines were moved, deleted, created and reconstructed.

2.23.5 Reserved

2.24 RESERVED

2.25 FD 25 - GIS RASTER TO VECTOR CONVERSION

2.25.1 Objective

Demonstrate the capability of the proposed GIS to convert a multi-value discrete raster map data set into a point, line and polygon vector format data set.

2.25.2 RFP References

J.11.3.2.8.2

2.25.3 Instructions

In this FD a multi-value raster data set containing information about point, line and polygonal features, will be converted into vector data sets that contain point, line and polygonal features with the associated information drawn from the raster data set. The methodology used will therefore have to provide for recognition of distinct features with the help of list of values tied to subjects and features (value-subject-feature list), creation of vector coordinates and appropriate topology as required by the vector format.

Processing Environment

The following hardware shall be used for this FD:

PLE-C	Electrostatic Plotter on LAN C
WA-C	Advanced Workstation on LAN C

2.25.3.1 Script

a. Read the raster transfer format file RASTER1 into the proposed GIS.

b. The vectorizing process is an automated process that consists of the following steps, not necessarily in this order.

   1. Identify which cells represent points, lines or polygons (use input map RASTER1).

   2. Fit vector polygons for all the features, without distinguishing between points, lines and polygons.

   3. Fit vector polygons into cells representing polygonal features (be aware of islands).

4. Fit vector lines into cells representing line features.

5. Fit vector points into cells representing point features.

6. Weed out unnecessary coordinate pairs for all the above vectorized maps.

7. Create topology.

c. The output should reside in vector format file VECT1MAP#. Create and plot the following files on PLE-C:

   1. Vector map containing polygons for all the features (VECT1MAP1).

   2. Vector map containing points (VECT1MAP2).

   3. Vector map containing lines (VECT1MAP3).

   4. Vector map containing polygons (VECT1MAP4).

   In addition, create a report for each type of feature (point, line, and polygon) as specified in the expected Output section below.

d. Repeat the above process (points 1-3) for data files RASTER2 and RASTER3 to produce vector maps VECT(x)MAP(y) where x represents the number of the input file (i.e., RASTERx) and y represents the number of the product associated with that input file(i.e., VECT1MAPy).

e. Read in MAPS format map RASTER4 and vectorize it into polygons and points.

f. Read and display MOSS point, line and polygon files which were used as the source of the raster data made available for vectorization, and which will be brought to the test site on the day of the test.

g. Simultaneously display on the screen the original vector set (referred to in step 6 above) and the created vector set, and plot out and create overlays of the original vector set and the created vector set for the purpose of comparison of the created data with the original vector data. The expected scale of the plots is 1:24,000. Prepare a report for each map in which the area, perimeter, frequency and length (as appropriate to the data set) is summarized by cell value and subject. The format of the report is specified in the Expected Output section below.

h. Demonstrate that appropriate topologies have been created.

2.25.3.2 Data

The data for this FD is supplied in Appendix D, Government Supplied Data.

2.25.3.3 Reserved

2.25.4 Expected Output

The expected output shall include vector format files named VECTxMAPy as described above in point 4. Each of the files will contain the appropriate vector information with appropriate topologies. The output will also consist of screen display and transparent plots (scale 1:24,000) of the created vector data sets which then can be compared to the original vector data sets for similarity, as well as a report listing area, perimeter, length, and frequency for both the created files and the original vector files supplied by BLM. For screen displays a simultaneous display of the original vector data set (provided at the evaluation) and the created data set will be will be provided. Plots of the original and created vector sets shall be prepared by the Offeror on site for comparison by overlaying of maps on a light table. The Offeror also will demonstrate that appropriate topologies have in fact been created.

The output shall contain reports for the polygons, lines, and points in the vectorized map. Polygon, line, and point data shall each be reported separately. Each report shall contain one line per feature (point, line, or polygon) and be sorted in descending order by the subject field. The final record shall be a record of totals in the same format.

For each polygon the output shall be as follows:

Field	Columns	Format
Subject	01-30	A30
Item	31-35	I5
Perimeter (in miles)	36-45	F10.2
Area (in acres)	46-55	F10.2
Islands	56-60	I5
Points in polygon	61-65	I5

For each line the output shall be as follows:

Field	Columns	Format
Subject	01-30	A30
Item	31-35	I5
Length (in miles)	36-45	F10.2
Points in line	46-50	I5

For each point the output shall be as follows:

Field	Columns	Format
Subject	01-30	A30
Latitude	31-42	F12.2
Longitude	43-54	F12.2

2.25.5 **Reserved**

2.26 FD 26 - GIS BUFFER ZONE DEVELOPMENT

2.26.1 Objective

Demonstrate the capability of the proposed GIS to (1) Develop single or multiple buffer zones around features (points, lines, polygons, and combinations thereof) selected by subject, attribute, geographic window, or size; (2) Buffer data sets with a large number of features; (3) Resolve overlaps; (4) Preserve islands; and (5) Combine subjects and attributes.

2.26.2 RFP References

C.4.3.1
J.11.2.14
J.11.2.16.1
J.11.3.1.1.6
J.11.3.1.2.1
J.11.3.1.2.3
J.11.3.2.1
J.11.3.2.2.3
J.11.3.2.2.5
J.11.3.2.3
J.11.3.2.3.4
J.11.3.2.5
J.11.3.2.5.5
J.11.3.2.8
J.11.3.2.13
J.11.3.2.14.16
J.11.3.2.16
J.11.3.2.18
J.11.3.2.18.1
J.11.3.2.18.15
J.11.3.2.18.20
J.11.3.2.19.1
J.11.3.3.1
J.11.3.3.1.14
J.11.3.3.2.9
J.11.3.3.2.8
J.11.3.4.5.5

2.26.3 Instructions

In this FD, buffers shall be produced around features supplied by the Government. Each buffer shall be in the form of a set of topologically structured polygons, each with the same subject. (A subject is a type of alphanumeric attribute associated with a feature such as a point, line, or polygon.)

In the development of buffers, any overlaps within the buffers shall be resolved. This means: 1) No point, line, or area may be represented in a buffer more than once; and 2) No point may fall inside two or more polygons representing portions of a single buffer. Any buffer polygons which meet or overlap shall be combined into a single polygon. No buffered polygon shall overlap itself so that it produces convoluted, invalid islands. Rather, the buffered polygon shall be adjusted to cause it to be a simple polygon such that a point travelling clockwise around the polygon always has the inside of the polygon to the right of its direction of motion.

In the development of buffers, islands shall be preserved. That is, any area inside an original polygon which is farther from the polygon than the specified width of the buffer must remain outside of the buffer. Also, any area which is surrounded by polygons representing parts of a buffer, but not falling within the specified width of the buffer from any feature being buffered, must remain outside the buffer.

Scripts 2.26.3.1.1 through 2.26.3.1.7 shall be performed on an advanced workstation. Scripts 2.26.3.1.8 and 2.26.3.1.9 may be performed either on the workstation or the multi-user processor.

Processing Environment

The following hardware shall be used for this FD:

HC-C	Color Hard Copy Unit on LAN C
MPA-A	Multi-user Processor - Class A on LAN A
PLE-C	Electrostatic Plotter on LAN C
PLP-C	Pen Plotter on LAN C
WA-C	Advanced Workstation on LAN C

2.26.3.1 Script

2.26.3.1.1 Script for File TC15

a. Read in MOSS data set TC15.

b. User shall specify all features from data set TC15 for buffers.

c. User shall specify output data set name, "TC15.BUF."

d. User specifies buffer parameters:

   1. User specifies units = meters (default).

   2. User specifies inside and outside with same criteria.

   3. User specifies 1 buffer at 30 meters.

   4. User chooses system provided default for subjects for buffered areas (B30).

e. Perform the buffer function on the selected subset. Produce a set of buffered polygons in the output file specified which contains a 30 meter buffer zone around each feature in the input data set. Assign each polygon in these buffers the subject B30, as appropriate to its parameters. Capture performance metrics and produce a Performance Metrics Report.

f. Display, on a workstation, each in a different color from the original data set, and in a different color from one another, the original set of features included in the specified data set and all of the polygons with the subject "B30." Label all polygons with their subjects.

g. Provide a 1:24000 scale hard copy plot on PLP-C in the same projection as the original data set using the description in step 6.

h. Display on the workstation and provide a hard copy Polygon Report including the subject, area, and perimeter of each polygon which is in the output file. Sort by subject, and total all statistics by subject and percentage of total area. Include cumulative summaries.

2.26.3.1.2 Script for File TC16

a. Read in MOSS data set TC16.

b. User shall specify all features from data set TC16 for buffers.

c. User shall specify output data set name, "TC16.BUF."

d. User specifies buffer parameters:

   1. User specifies units = meters (default).

   2. User specifies inside and outside with same criteria.

   3. User specifies 3 buffers at 10, 20 and 30 meters.

   4. User choose system provided default for subjects for buffered areas (e.g. B10, B20, B30).

e. Perform the buffer function on the selected subset. Produce a set of buffered polygons in the output file specified which contains a 10 meter, a 20 meter, and a 30 meter buffer zone around each feature in the input data set. Assign each polygon in these buffers the subject B10, B20, or B30, as appropriate to its parameters. Capture performance metrics and produce a Performance Metrics Report.

f. Display, on a workstation, each in a different color from the original data set, and in a different color from one another, the original set of features included in the specified data set and all of the polygons with the subject "B10", "B20", and "B30." Label all polygons with their subjects.

g. Provide a 1:24000 scale hard copy plot on PLP-C in the same projection as the original data set using the description in step 6.

h. Display on the workstation and provide a hard copy Polygon Report including the subject, area, and perimeter of each polygon which is in the output file. Sort by subject, and total all statistics by subject and percentage of total area. Include cumulative summaries.

2.26.3.1.3 First Script for File TC17

a. Read in MOSS data set TC17.

b. User shall specify Feature 2 from data set TC17 for buffers.

c. User shall specify output data set name, "TC17.BUF1."

d. User specifies buffer parameters:

  1. User specifies units = kilometers.

  2. User specifies that the buffer be to the outside of the polygon.

  3. User specifies 3 buffers at 1, 2 and 3 kilometers.

  4. User choose system provided default for subjects for buffered areas (e.g., B1, B2, B3).

e. Perform the buffer function on the selected subset: Produce a set of buffered polygons in the output file specified which contains a 1 kilometer, a 2 kilometer, and a 3 kilometer buffer zone around each feature in the input data set. Assign each polygon in these buffers the subject B1, B2, or B3, as appropriate to its parameters. Capture performance metrics and produce a Performance Metrics Report.

f. Display, on a workstation, each in a different color from the original data set, and in a different color from one another, the original set of features included in the specified data set and all of the polygons with the subject "B1", "B2", and "B3." Label all polygons with their subjects.

g. Provide a 1:24000 scale hard copy plot on PLP-C in the same projection as the original data set using the description in step 6.

h. Produce a Polygon Report including the subject, area, and perimeter of each polygon which is in the output file. Sort by subject, and total all statistics by subject and percentage of total area. Include cumulative summaries, and include "null" areas if in the data set.

2.26.3.1.4 Second Script for File TC17

a. Read in MOSS data set TC17.

b. User shall specify Feature 2 from data set TC17 for buffers.

c. User shall specify output data set name, "TC17.BUF2."

d. User specifies buffer parameters:

   1. User specifies units = kilometers.

   2. User specifies that the buffer be to the inside of the polygon.

   3. User specifies 3 buffers at 1, 2 and 3 kilometers.

   4. User choose system provided default for subjects for buffered areas (e.g. B1, B2, B3).

e. Perform the buffer function on the selected subset. Produce a set of buffered polygons in the output file specified which contains a 1 kilometer, a 2 kilometer, and a 3 kilometer buffer zone inside of each feature in the input data set. Assign each polygon in these buffers the subject B1, B2, or B3, as appropriate to its parameters. Capture performance metrics and produce a Performance Metrics Report.

f. Display, on a workstation, each in a different color from the original data set, and in a different color from one another, the original set of features included in the specified data set and all of the polygons with the subject "B1", "B2", and "B3." Label all polygons with their subjects.

g. Provide a 1:24000 scale hard copy plot on PLP-C in the same projection as the original data set using the description in step 6.

h. Produce a Polygon Report including the subject, area, and perimeter of each polygon which is in the output file. Sort by subject, and total all statistics by subject and percentage of total area. Include cumulative summaries, and include "null" areas if in the data set.

2.26.3.1.5 Script for File TC18

a. Read in MOSS data set TC18.

b. User shall specify any subject containing a "1" from data set TC18 for buffers.

c. User shall specify output data set name, "TC18.BUF."

d. User specifies buffer parameters:

   1. User specifies units = kilometers.

   2. User specifies that the buffers be to the outside of the polygon.

   3. User specifies 2 buffers at .5 and 1 kilometer.

   4. User choose system provided default for subjects for buffered areas (B.5, B1).

e. Perform the buffer function on the selected subset. Produce a set of buffered polygons in the output file specified which contains a .5 kilometer and a 1 kilometer buffer zone around each feature in the input data set. Assign each polygon in these buffers the subject "B.5" or "B1", as appropriate to its parameters. Capture performance metrics and produce a Performance Metrics Report.

f. Display, on a workstation, each in a different color from the original data set, and in a different color from one another, the original set of features included in the specified data set and all of the polygons with the subject "B.5" and "B1." Label all polygons with their subjects.

g. Provide a 1:24,000 scale hard copy plot on PLP-C in the same projection as the original data set using the description in step 6.

h. Produce a Polygon Report including the subject, area, and perimeter of each polygon which is in the output file. Sort by subject, and total all statistics by subject and percentage of total area. Include cumulative summaries, and include "null" areas if in the data set.

2.26.3.1.6 Script for File B.TESTRL

a. Read in MOSS Data set B.TESTRL.

b. User shall specify feature 30 from data set B.TESTRL for buffer.

c. User shall specify output data set name, "B.TESTRL.BUF1."

d. User specifies buffer parameters:

   1. User specifies units = meters (default).

   2. User specifies 2 buffers at 50 and 100 meters.

   3. User choose system provided default for subjects for buffered areas (B50, B100).

e. Perform the buffer function on the selected subset: Produce a set of buffered polygons in the output file specified which contains a 50 meter and a 100 meter buffer zone around each feature in the input data set. Assign each polygon in these buffers the subject "B50" or "B100", as appropriate to its parameters. Capture performance metrics and produce a Performance Metrics Report.

f. Display on a workstation, each in a different color from the original data set, and in a different color from one another, the original set of features included in the specified data set and all of the polygons with the subject "B50" and "B100." Label all polygons with their subjects.

g. Provide a 1:24,000 scale hard copy plot on PLP-C in the same projection as the original data set using the description in step 6.

h. Produce a Polygon Report including the subject, area, and perimeter of each polygon which is in the output file. Sort by subject, and total all statistics by subject and percentage of total area. Include cumulative summaries, and include "null" areas if in the data set.

2.26.3.1.7 Script for File MATT.S and MATT.S.AT

a. Read in MOSS Data set MATT.S and MATT.S.AT.

b. User shall specify features from data set MATT.S for buffers using a key field from the multiple attribute file MATT.S.AT in whatever form it takes after it has been read into the system. The features with the following "API.NUM"s will be used as the specified dataset: 30735, 30734, 3073, 30715, 30724, 30730, and 30705.

c. User shall specify output data set name, "MATT.S.BUF."

d. User specifies buffer parameters:

   1. User specifies units = meters (default).

   2. User specifies 1 buffer at 100 meters.

   3. User choose subject and multiple attribute key "API.NUM" for the two identifying characteristics to be assigned to the output features.

   4. If initial buffers overlap, subjects shall be concatenated, and the API.NUM attribute shall be concatenated, and the output polygon shall be assigned the combined subject and attribute which is appropriate.

e. Perform the buffer function on the selected subset. Produce a set of buffered polygons in the output file specified which contains a 100 meter buffer zone around each feature in the input data set. Assign each polygon in these buffers the subject and attribute combination appropriate to its parameters. Capture performance metrics and produce a Performance Metrics Report.

f. Display on a workstation, in a different color from one another, the original set of features included in the specified data set and all of the polygons in the output data set. Label all polygons with their combined subjects and API.NUM attributes.

g. Provide a 1:24,000 scale hard copy plot on PLP-C in the same projection as the original data set using the description in step 6.

h. Produce a Polygon Report including the subject, API.NUM, area, and perimeter of each polygon which is in the output file. Sort by subject, and total all statistics by subject and percentage of total area. Include cumulative summaries, and include "null" areas if in the data set.

2.26.3.1.8 Script for High Volume Buffer Zone - ADS Line Files AD34117 and EH33117

a. Read in ADS Data sets AD34117 and EH33117.

b. User shall specify all features from data set AD34117 and EH33117 buffers.

c. User shall specify output data set name, ADSLINES.BUF.

d. User specifies buffer parameters:

   1. User specifies units = miles.

   2. User specifies 1 buffers at .25 miles.

   3. User choose system provided default for subjects for buffered areas (B.25).

e. Perform the buffer function on the selected subsets: Produce a set of buffered polygons in the output file specified which contains a .25 mile buffer zone around each feature in the input data sets. Assign each polygon in these buffers the subject "B.25", as appropriate to its parameters. Polygons will appear to be contiguous across the original map boundary. That is, the original common data set boundary will not appear in the output buffer file. Capture performance metrics and produce a Performance Metrics Report.

f. Display on a workstation, in a different color from one another, the original set of features included in the specified data set and all of the polygons with the subject "B.25." Label all polygons with their subjects.

g. Provide a 1:100,000 scale hard copy plot on PLE-C in the same projection as the original data set using the description in step 6.

h. Produce a Polygon Report including the subject, area, and perimeter of each polygon which is in the output file. Sort by subject, and total all statistics by subject and percentage of total area. Include cumulative summaries, and include "null" areas if in the data set.

2.26.3.1.9 Script for High Volume Buffer Zone - MOSS Polygon Files SCTWOLFRG and SCTSAGEHL

a. Read in MOSS Data sets SCTWOLFRG and SCTSAGEHL.

b. User shall specify all features with the subjects "XX", "XX", "XX", and "XX" from data sets SCTWOLFRG and SCTSAGEHL for buffers.

c. User shall specify output data set name, "POLYGON.BUF."

d. User specifies buffer parameters:

   1. User specifies units = miles.

   2. User specifies that the buffer be to the outside of the polygons.

   3. User specifies 1 buffer at .25 mile.

   4. User choose system provided default for subjects for buffered areas (e.g. B.25).

e. Perform the buffer function on the selected subsets: Produce a set of buffered polygons in the output file specified which contains a .25 mile buffer zone around each feature in the input data set. Assign each polygon in these buffers the subject B.25, as appropriate to its parameters. Polygons will appear to be contiguous across the original map boundary. That is, the original common data set boundary will not appear in the output buffer file. Capture performance metrics and produce a Performance Metrics Report.

f. Display on a workstation, in a different color from one another, the original set of features included in the specified data set and all of the polygons with the subject "B.25." Label all polygons with their subjects.

g. Provide a 1:24,000 scale hard copy plot on PLE-C in the same projection as the original data set using the description in step 6.

h. Produce a Polygon Report including the subject, area, and perimeter of each polygon which is in the output file. Sort by subject, and total all statistics by subject and percentage of total area. Include cumulative summaries, and include "null" areas if in the data set.

2.26.3.2 Data

The data files for these FD scripts are supplied in Appendix D, Government Supplied Data.

2.26.3.3 Programs

USGS projection package as supplied in Appendix D, Government Supplied Data, or an equivalent package, may be used.

2.26.4 Expected Output

The output from the FD shall include the files named in each individual FD Script containing topologically structured polygons as described above, with subjects assigned as above. The projection of the output files shall be the same as the input files.

The output shall include hard copy prints or plots of the original features and the resultant buffers, as described above.

2.26.4.1 Polygon Report Format

The output shall contain a report for all polygons resulting from each buffering operation. The report shall contain a record for each polygon with the records sorted in descending order by the subject field. The final record shall be a record of totals in the same format.

For each polygon the output shall be as follows:

Field	Columns	Format
Subject	01-30	A30
Item	31-35	I5
Perimeter (in miles)	36-45	F10.2
Area (in acres)	46-55	F10.2
Islands	56-60	I5
Points in polygon	61-65	I5

2.26.4.2 Performance Metrics Report Format

Performance Reports recording performance metrics shall be in the following format:

Start Position	End Position	Field Name	A/N	Description
1	1	Step	N	Step Number
2	23	Filler		
24	26	ElapseSSS	N	Elapsed Time: Seconds
27	30	ElapseTTTT	N	Elapsed Time: Tenthousandths
31	33	TotCPUSec	N	Total CPU Time: Seconds
34	37	TotCPUTT	N	Total CPU Time: Tenthousandths
38	40	CPUSec1	N	1st CPU Time: Seconds
41	44	CPUTT1	N	1st CPU Time: Tenthousandths
45	47	CPUSec2	N	2nd CPU Time: Seconds[1]
48	51	CPUTT2	N	2nd CPU Time: Tenthousandths[1]
52	56	TotDIO	N	Tot Dir I/O Count for All Dev
57	60	DIO1	N	Dir I/O Count for First Device
61	64	DIO2	N	Dir I/O Count for Second Dev[1]
65	68	DIO3	N	Dir I/O Count for Third Dev[1]
69	72	DIO4	N	Dir I/O Count for Fourth Dev[1]
73	77	TotBIO	N	Tot Buff I/O Count for All Dev
78	81	BIO1	N	Buff I/O Count for First Dev
82	85	BIO2	N	Buff I/O Count for Second Dev[1]
86	89	BIO3	N	Buff I/O Count for Third Dev[1]
90	93	BIO4	N	Buff I/O Count for Fourth Dev[1]
94	100	PgFaults	N	Number of Page Faults

2.26.5 Reserved

---

[1] For use only if necessary.

2.27 RESERVED

2.28 FD 28 - GIS PROXIMITY

2.28.1 Objective

Demonstrate the capability of the proposed GIS to ascertain which features (points, lines, and polygons) are proximate to specified features.

2.28.2 RFP References

J.11.3.2.1.15
J.11.3.2.1.16
J.11.3.2.3.7
J.11.3.2.13.3
J.11.3.2.18.15
J.11.3.2.18.16
J.11.3.2.18.18
J.11.3.2.18.23
J.11.3.2.18.25
J.11.3.2.18.28
J.11.3.2.18.30
J.11.3.2.25.1
J.11.3.3.1.3
J.11.3.3.1.7
J.11.3.3.1.10
J.11.3.3.1.14
J.11.3.3.2.8.e
J.11.3.3.2.9.a
J.11.3.3.2.9.c
J.11.3.3.2.9.d
J.11.3.3.2.9.e
J.11.3.3.2.13
J.11.3.3.2.19
J.11.3.3.2.21

2.28.3 Instructions

In this FD, map features will be retrieved based upon distance. Features will be retrieved that reside within or outside of a specified distance from a feature or features in a source map or from a user specified location. The product will include all features that meet the specified distance criteria.

If the within option is exercised, all features will be retrieved that reside completely or partially within the specified distance from the features in a source map or from a specified location. Features will be retrieved if any of its coordinates or any portion of any line segment (where a line segment represents line data or part of a polygon boundary) resides within or is equal to the specified distance from any coordinate or line segment of any feature in the source map. If any coordinate or portion of a line segment in a feature falls within or is equal to the specified distance, the entire feature will be retrieved. All features that are completely enclosed by any feature other than an island in the source map will also be retrieved with this option.

If the outside option is exercised, all features will be retrieved that reside completely beyond the specified distance from features in a source map or from a specified location. Features will be retrieved if all of its coordinates and line segments fall beyond the specified distance from all coordinates and line segments of features in the source map.

The distance specification for the within and outside options must be provided in measurement units of feet, meters or miles. The specified location to search from should be specified by keyboard entry of a latitude and longitude, with a crosshair, or with a cursor on the screen.

The original geographic and attribute integrity of all features will be retained throughout the data base. All features will be retrieved in their entirety for the geographic window or study area despite the internal boundaries of base maps such as lines representing quadrangle boundaries. That is to say, the boundaries of base maps such as quad lines will not be used to divide any map feature where the attribute or attributes on both sides of the line are the same.

Processing Environment

The following hardware shall be used for this FD:

MPA-A	Multi-user Processor - Class A on LAN A
PLE-C	Electrostatic Plotter on LAN C
PSW-C	Serial Printer Wide on LAN C
WA-C	Advanced Workstation on LAN C

2.28.3.1 Script

2.28.3.1.1 Script for File SCTWOLFRG Inside 0.25 Mile Proximity

The following steps shall be performed using the file SCTWOLFRG.

a. Read the file SCTWOLFRG into the proposed GIS.

b. Retrieve the polygons from file SCTWOLFRG with the subject 522SG that are within .25 miles of the polygons in files SCTWOLFRG with the subject 423PJSG. Capture performance metrics and produce a Performance Report on the retrieval operation.

c. Display and plot all of the polygons from file SCTWOLFRG with the subject 522SG and the polygons from file SCTWOLFRG with the subject 423PJSG. Shade the polygons with 423PJSG subject with a single crosshatch and shade the polygons with subject 522SG that were retrieved according to the .25 mile distance parameter in a double crosshatch.

d. Produce a tabular listing including attributes of the features in file SCTWOLFRG that were retrieved.

2.28.3.1.2 Script for File SCTWOLFRG Inside 2 Mile Proximity

The following steps shall be performed using the file SCTWOLFRG.

a. Read the file SCTWOLFRG into the proposed GIS.

b. Retrieve the polygons from file SCTWOLFRG with the subject 522SG that are within 2 miles of the polygons in file SCTWOLFRG with the subject 423PJSG. Capture performance metrics and produce a Performance Report on the retrieval operation.

c. Display and plot all of the polygons from file SCTWOLFRG with the subject 522SG and the polygons from files SCTWOLFRG with the subject 423PJSG. Shade the polygons with 423PJSG subject with a single crosshatch and shade the polygons with subject 522SG that were retrieved according to the 2 mile distance parameter in a double crosshatch.

d. Produce a tabular listing including attributes of the features in file SCTWOLFRG the were retrieved.

2.28.3.1.3 Script for File SCTWOLFRG Outside 0.25 Mile Proximity

The following steps shall be performed using the file SCTWOLFRG.

a. Read the file SCTWOLFRG into the proposed GIS.

b. Retrieve the polygons from file SCTWOLFRG with the subject 522SG that are outside .25 of a mile from the polygons in files SCTWOLFRG with the subject 423PJSG. Capture performance metrics and produce a Performance Report on the retrieval operation.

c. Display and plot all of the polygons from file SCTWOLFRG with the subject 522SG and the polygons from files SCTWOLFRG with the subject 423PJSG. Shade the polygons with 423PJSG subject with a single crosshatch and shade the polygons with subject 522SG that were retrieved according to the .25 mile distance parameter in a double crosshatch.

d. Produce a tabular listing including attributes of the features in file SCTWOLFRG the were retrieved.

2.28.3.1.4 Script for File SCTWOLFRG Outside 2 Mile Proximity

The following steps shall be performed using file SCTWOLFRG.

a. Read the file SCTWOLFRG into the proposed GIS.

b. Retrieve the polygons from file SCTWOLFRG with the subject 522SG that are outside of 2 miles from the polygons in file SCTWOLFRG with the subject 423PJSG. Capture performance metrics and produce a Performance Report on the retrieval operation.

c. Display and plot all of the polygons from file SCTWOLFRG with the subject 522SG and the polygons from files SCTWOLFRG with the subject 423PJSG. Shade the polygons with 423PJSG subject with a single crosshatch and shade the polygons with subject 522SG that were retrieved according to the 2 mile distance parameter in a double crosshatch.

d. Produce a tabular listing including attributes of the features in file SCTWOLFRG the were retrieved.

2.28.3.1.5 Script for Files SCTWOLFRG and MDRWOLFRG

The following steps shall be performed using files SCTWOLFRG and MDRWOLFRG.

a. Read files SCTWOLFRG and MDRWOLFRG into the proposed GIS.

b. Retrieve the polygons from files SCTWOLFRG with the subject 423PJSG that are outside of 5 miles from the polygons in files MDRWOLFRG with the subject Deer Winter Range. Capture performance metrics and produce a Performance Report on the retrieval operation.

c. Display and plot all of the polygons from files SCTWOLFRG with the subject 423PJSG and the polygons from file MDRWOLFRG with the subject Deer Winter Range. Shade the polygons with Deer Winter Range subject with a single crosshatch and shade the polygons with subject 423PJSG that were retrieved according to the 5 mile distance parameter in a double crosshatch.

d. Produce a tabular listing including attributes of the features in files SCTWOLFRG and MDRWOLFRG the were retrieved.

2.28.3.2 Data

The data for this FD is supplied in Appendix D, Government Supplied Data.

2.28.3.3 Reserved

2.28.4 Expected Output

All products shall retain the integrity of the original data base.

2.28.4.1 Area Summary Report Format

All tabular outputs shall include at a minimum; the map name, the subject, the area, the frequency of occurrence, the percent of the total map the subject occupies, and totals for acres, frequency, and percentage for all subjects of interest. An example of the tabular output follows.

Area Summary for map MDRWOLFRG

SUBJECT	AREA	FREQUENCY	PERCENT
MULE DEER SUMMER RANGE	122.46	1	.34
MULE DEER WINTER CONC/WINT RGE	6398.34	3	17.49
MULE DEER WINTER RANGE	30053.34	1	82.17
TOTAL (IN ACRES)	36574.10	5	100.00

2.28.4.2 **Performance Metrics Report Format**

Performance Reports recording performance metrics shall be in the following format:

Start Position	End Position	Field Name	A/N	Description
1	1	Step	N	Step Number
2	23	Filler		
24	26	ElapseSSS	N	Elapsed Time: Seconds
27	30	ElapseTTTT	N	Elapsed Time: Tenthousandths
31	33	TotCPUSec	N	Total CPU Time: Seconds
34	37	TotCPUTT	N	Total CPU Time: Tenthousandths
38	40	CPUSec1	N	1st CPU Time: Seconds
41	44	CPUTT1	N	1st CPU Time: Tenthousandths
45	47	CPUSec2	N	2nd CPU Time: Seconds[1]
48	51	CPUTT2	N	2nd CPU Time: Tenthousandths[1]
52	56	TotDIO	N	Total Direct I/O Count for All Dev
57	60	DIO1	N	Direct I/O Count for First Device
61	64	DIO2	N	Direct I/O Count for Second Device[1]
65	68	DIO3	N	Direct I/O Count for Third Device[1]
69	72	DIO4	N	Direct I/O Count for Fourth Device[1]
73	77	TotBIO	N	Total Buffered I/O Count for All Dev
78	81	BIO1	N	Buffered I/O Count for First Device
82	85	BIO2	N	Buffered I/O Count for Second Dev[1]
86	89	BIO3	N	Buffered I/O Count for Third Device[1]
90	93	BIO4	N	Buffered I/O Count for Fourth Dev[1]
94	100	PgFaults	N	Number of Page Faults

2.28.5 **Reserved**

---

[1] For use only if necessary.

2.29 FD 29 - GIS RECTANGULAR SURVEYS / METES AND BOUNDS

2.29.1 Objective

Demonstrate the capability of the proposed solution to calculate and store latitude and longitude and Universal Transverse Mercator (UTM) coordinates from the bearings and distances on the official cadastral record for the rectangular survey system, and then calculate, adjust for closure, and store latitude and longitude and UTM coordinates of a set of angle points described by a metes and bounds description.

2.29.2 RFP References

J.11.3.2.9.2
J.11.3.3.1
J.11.3.3.2
J.11.3.4.2
J.11.3.4.3
J.11.3.4.4
J.11.3.4.5
J.11.3.4.5.1
J.11.3.4.5.2
J.11.3.4.5.3
J.11.3.4.5.4
J.11.3.4.5.5
J.11.3.4.5.7
J.11.3.4.6
J.11.3.4.7
J.11.3.4.8
J.11.3.4.11

2.29.3 Instructions

In this FD, latitude and longitude coordinate shall be calculated for townships and a metes and bounds legal description that calls to aliquot part lines or corners. In this FD the definition of a "call" is any aliquot survey line or aliquot corner within the rectangular survey system i.e., section lines, quarter lines, sixteenth lines, sections corners, quarter corners, or sixteenth corners.

The following definitions are to be used throughout functional demonstration 29:

CALL - A reference to, or statement of, an object, course, distance or other matter or description in a survey or grant requiring or calling for a corresponding object, or other matter of description, on the land.

ALIQUOT - Contained an exact number of times in another; a part of a measurement that divides the measurement without a remainder.

ALIQUOT PARTS - Legal subdivisions, except fractional lots, or further subdivision of any smaller legal subdivision, except fractional lots, by division into halves or fourths ad infinitum.

In the development of metes and bounds portion of this FD, no legal interpretation of the description is intended. Use only the bearings, distances and calls provided by the Government for the metes and bounds description, previously calculated coordinates for the townships, and the original input data for the township. Calculate the latitude and longitude for each angle point and missing aliquot part corner. Constraining calls must be honored for the metes and bounds description.

The file layout for the metes and bounds description contains four areas; Direction, Bearings, Distances, and Calls. Direction will be either NE, NW, SW, or SE. Bearings will be described as; Degrees, Minutes and Seconds. Distance will be described in chains, tenths, hundredths, and thousands of a chain. Calls will be described by a direction, aliquot line(s) or corner(s), and the section number of the line or corner referenced, e.g., N SW1/4 10. (North line of the Southwest quarter of Section 10). See data section for detailed record layout.

Processing Environment

The following hardware shall be used for this FD:

HC-C	Color Hard Copy Unit on LAN C
PLP-C	Pen Plotter on LAN C
PSW-C	Serial Printer Wide on LAN C
WA-C	Advanced Workstation on LAN C

2.29.3.1 Script

2.29.3.1.1 Script for First Township Setup

The following steps shall be performed once for the first township supplied:

a. Load the supplied latitude and longitude of the 4 control points for the first township from the file J22N6W.IN.

b. Load the supplied record bearings and distances for corners in the township (the data will not be provided in any set order) from the file J22N6W.IN.

c. Calculate, display, and print the latitude and longitude of all corners represented in the input data for the township.

d. Determine, display, and print the error of closure for all traverses between control points. (A traverse is a sequence of bearings and distances of lines between points).

e. Adjust the latitude and longitude of all corners to account for the error of closure and convert to UTM coordinates. Display and print the adjusted coordinates. Use the same order as the input file. Produce a hard copy of the adjusted coordinates.

2.29.3.1.2 Script for Subsequent Township Setup

The following steps shall be performed for each subsequent township:

a. From the files J22N7W.IN and J22N8W.IN, load the latitude and longitude of the control points of this township which have not been input in conjunction with previously entered townships.

b. Retrieve previously entered or calculated corners which occur both in this township and in any previously input township.

c. Calculate, display, and print the latitude and longitude of all corners represented in the input data for the township.

d. Determine, display, and print the error of closure for all remaining traverses between control points.

e. Adjust the latitude and longitude of all newly calculated corners to account for the error of closure and convert to UTM coordinates. Display and print the adjusted coordinates. Use the same order as the input file. Produce a hard copy of the adjusted coordinates.

2.29.3.1.3 Script for Metes and Bounds Processing

The following steps shall be performed once:

a. Load the metes and bounds legal description supplied by the Government in file MBDESC.

b. Calculate, display, and print the latitude and longitude of each angle point and any additional control aliquot referenced in the description based upon bearings and distances in the legal description. In the event that a call is used in the legal description, it takes precedence over the corresponding distance in the legal description. (For the purpose of this FD, a call is a reference to a section line, quarter line, sixteenth line, section corner, quarter corner, or sixteenth corner.)

c. Adjust the latitude and longitude of each angle point to account for the error of closure, within the constraints of legal calls. Display and print the results.

d. Display and plot each township plat on PLP-C at a scale of 1:24,000. Annotate each line with the bearing and distance supplied by the Government. Annotate each corner with the adjusted latitude and longitude coordinates. Include and annotate each line of the metes and bounds description supplied by the Government and annotate each angle point with the adjusted latitude and longitude coordinates.

e. Print and save to a file the input bearings and distances, the adjusted coordinates of the corners, the supplied metes and bounds legal description, and the adjusted coordinates of the angle points. Use the same order as in the input file.

2.29.3.2 Data

The data supplied for this FD is found in files J22N6W.IN, J22N7W.IN, J22N8W.IN, and MBDESC, described in Appendix D, Government Supplied Data. The data consists of Rectangular Input and Metes and Bounds Description. The Rectangular Input consists of meridian, township, range, corner point ID, record bearing and distance, latitude and longitude of township corners, and mean project elevation. The Metes and Bounds Description consists of reference meridian, township, and range, starting point, and bearing, distance, and calls.

2.29.3.3 Reserved

2.29.4 Expected Output

The plat for each township in which the metes and bounds description falls will be displayed on the screen and plotted as specified in the script above.

For each township, the Offeror will create a table containing the corner and angle point coordinates resulting from the FD in the same order as the input file.

2.29.5 Reserved

2.30 RESERVED

2.31 RESERVED

2.32 RESERVED

2.33 RESERVED

2.34 FD 34 - STANDARDIZED NAME IDENTIFICATION

2.34.1 Objective

The objective of this functional demonstration is for the Offeror to demonstrate the capability to (1) create and maintain a master name file; and (2) perform imprecise matching of customer names.

2.34.2 RFP References

J.11.2.17

2.34.3 Instructions

The Offeror will be required to create a name record for each customer, containing the following information:

a. The customer's name and address(es); and

b. A unique name identifier for the customer, consisting of a twelve-character, alphanumeric field.

Once a name record has been created, it will be stored in a Master Name File. The Offeror will be required to demonstrate the capability for the user to update the Master Name File to reflect changes to the information fields identified above.

The Offeror will demonstrate the capability to compare different customer names and addresses and identify potential matches based upon similar spellings and/or pronunciations. Words or phrases with at least 80% of their characters matching constitute potential spelling matches. Words or phrases with at least 50% of their syllables matching constitute potential phonic matches.

For example, the following phrases within names or addresses would be flagged and displayed as possible matches:

a. American Telephone and Telegraph, American Telephone, American Tel & Tel, Amer Tel & Tel;

b. Al Paso, El Paso, Del Paseo;

The Offeror will also demonstrate the ability to match different addresses to a particular customer and display those addresses so that the user can choose the one most appropriate for the particular application being used. Responses shall be displayed on interactive screens and/or hard copy.

Processing Environment

The following hardware shall be used for this FD:

MPB-A	Multi-user Processor Class B on LAN A
PSN-A	Serial Printer Narrow on LAN A
WA-A	Advanced Workstation on LAN A

2.34.3.1 Script

a. Load the Government-supplied name and address and first case action data from the case recordation, status, and mining claims files.

b. Create a unique name identifier for each customer included in the Government-supplied data. This unique name identifier will consist of a twelve-character alphanumeric field.

c. Create a name record for each customer. The name record will include the customer's name, address, and unique name identifier.

d. Store the name record in the Master Name File.

e. Repeat this process until all of the customers included in the Government- supplied data have a name record which resides in the Master Name File.

f. Save the Master Name File to tape.

g. Perform an imprecise matching query for El Paso Natural Gas Company. Key in the customer's name and request the system to find or match that name, and display and print the name records for all possible matches.

h. Perform an imprecise matching query for Amer Tel & Tel. Key in the customer's name and request the system to find or match that name, and display and print the name records for all possible matches.

i. Perform an imprecise matching query for Finalco Energy Associates. Key in the customer's name and request the system to find or match that name and display and print the name records for all possible matches.

j. Perform an imprecise matching query for Howell Roberts Spear. Key in the customer's name and request the system to find or match that name and display and print the name records for all possible matches.

k. Perform an imprecise matching query for Northwestern Mutual Life Insurance Company. Key in the customer's name and request the system to find or match that name and display and print the name records for all possible matches.

l. Perform an imprecise matching query for BHP Petroleum Company, Inc. Key in the customer's name and request the system to find or match that name and display and print the name records for all possible matches.

m. Perform an imprecise matching query for Prudential Bache Energy Production, Inc. Key in the customer's name and request the system to find or match that name and display and print the name records for all possible matches.

n. Perform an imprecise matching query for George H. Zimmerman. Key in the customer's name and request the system to find or match that name and display and print the name records for all possible matches.

o. The Offeror will also be required to perform imprecise matching on one or more examples which will be given to each Offeror at the time of the Witnessed Demonstration. Display and print the results.

2.34.3.2 **Data**

The data for creating the Master Name File is supplied by the Government in Appendix D. It consists of name and address and first case action data from the following files:

a. Status;

b. Case Recordation;

c. Mining Claims.

2.34.3.3 **Reserved**

2.34.4 Expected Output

The output of this demonstration shall include a copy of the Master Name File on tape and various displays on a workstation as specified in the script.

2.34.5 Required Performance

Successful performance of the witnessed portion of this functional demonstration will require the Offeror to develop a program which will search the Master Name File and retrieve and display the applicant/customer's name record with the following execution duration times:

a. If the customer/applicant already has a name record stored in the Master Name File, the name record will be displayed for user verification within 45 seconds.

b. If there is no exact match for the customer/applicant's name with an existing name record in the Master Name File, the name records for possible name matches will be displayed within 45 seconds from the time the user keys the customer/applicant's name into the system.

2.35 FD 35 - GRAPHICS PERFORMANCE

2.35.1 Objective

Demonstrate the performance of the graphics display hardware and software proposed using PHIGS within the X Windows environment.

2.35.2 RFP References

C.4.10
C.4.11

2.35.3 Instructions

In this FD, the performance of the proposed display hardware for the following sequence of graphics operations will be demonstrated:

a. Drawing a black border 3 pixels wide around a square region (window) 300 pixels on each side.

b. Filling the window with a pattern of black and white pixels so that every other pixel, horizontally and vertically, is white, and the remaining pixels are black.

c. Drawing a hexagon, in white, centered in the window, with a line 1 pixel wide that inscribes a circle 200 pixels in radius.

d. Drawing a pentagon, in white, with a line 2 pixels wide, centered 50 pixels to the left of the center of the window, that inscribes a circle 100 pixels in radius.

e. Filling the region between the pentagon and the hexagon with black.

f. Drawing a circle, in white, with a line width of five pixels, centered on the pentagon, with a radius of 120 pixels.

g. Drawing 256 lines, each five pixels wide and 120 pixels long, from the center of the window. Line n should be drawn at an angle of 360n/256 degrees counter-clockwise from horizontal to the right. Each line should be a different color/shade of grey. If fewer than 8 bitplanes are available, the available colors/shades of grey should be cycled through repeatedly.

h. Zooming the window so that the upper left one quarter fills the window border.

i. Displaying a bitmap at the upper left corner of the zoomed window. Use the bitmap described in the Data section below.

j. Panning over the entire previous contents of the window, one pixel at a time: first to the right, then down, then to the left.

The Offeror will furnish programs that perform these graphics operations. One program will use only the proposed Xlib library to perform. One will use only the proposed PHIGS library to perform the operations. The same Xlib program shall run unmodified on the proposed Advanced, Personal, Basic and Administrative Workstations, and on the proposed X-Terminal. The PHIGS program shall run unmodified on the proposed Advanced, Personal and Basic Workstations.

These programs shall record the total elapsed time and total CPU time required to perform each step in the sequence of graphic operations. For the Xlib programs, elapsed time should be measured from the first call to the X library for that step until the program receives from the X server notice that it has finished the last request of the step. The program should wait until the X server completes a complete step before moving on to the next.

The collected performance data shall be saved in a file with the format given in the Data section below. Each test will also produce a printed report with the format given in the Expected Output section below.

The Offeror will provide source code for all the programs to the Government. The same source code shall be used for the PHIGS and Xlib programs running on all the display devices. The Offeror will document the commands necessary to produce executable output code from the source code.

Using the X-Window manager proposed, the PHIGS windows shall be maintained.

Processing Environment

The following hardware shall be used for this FD:

PSN-A	Serial Printer Narrow on LAN A
WA-A	Advanced Workstation on LAN A
WB-A	Basic Workstation on LAN A
WP-A	Personal Workstation on LAN A
WD-A	Administrative Workstation on LAN A
XT-A	X-Terminal on LAN A

2.35.3.1 Script

2.35.3.1.1 X-Terminal Script

The following will be performed with each proposed display of the proposed Administrative Workstation and X-Terminal:

a. Run the Xlib program. Print and save to tape the collected performance data. Print the source code of the program. Save to tape the source and executable object code of the program.

2.35.3.1.2 Workstation Script

The following will be performed with each proposed display of the proposed Basic, Personal, and Advanced Workstations.

a. Run the PHIGS program. Print and save to tape the collected performance data. Print the source code of the program. Save to tape the source and executable object code of the program.

b. Initiate an X Server for the display.

c. Run the Xlib program. Print and save to tape the collected performance data. Print the source code of the program. Save to tape the source and executable object code of the program.

2.35.3.2 Data

2.35.3.2.1 Bitmap Data

The data used in this demonstration is supplied in Appendix D, Government Supplied Data.

2.35.3.3 Reserved

2.35.4 Expected Output

The printed report produced by the programs should have the following format:

```
                                              Elapsed Time
Processor      Display       Test          for Step        CPU Time
XXXXXXXXXXXX   XXXXXXXXXX    XXXXXXX       99.9999         99.9999
```

Performance data collected from each of the test programs shall be saved in an ASCII file with 80 character records as follows:

Start	Length	Type	Description
1	10	Alpha	Processor
11	10	Alpha	Display
21	10	Alpha	Test Type (X,GKS,PHIGS)
31	2	Numeric	Step #
33	2	Numeric	Elapsed time (seconds)
35	4	Numeric	Elapsed time (ten thousandths)
39	2	Numeric	CPU Time (seconds)
41	4	Numeric	CPU Time (ten thousandths)
45	36	-	Filler

2.35.5 Reserved

APPENDIX D: GOVERNMENT SUPPLIED DATA

1.0 INTRODUCTION

1.1 PURPOSE

This appendix describes the data files needed for the Software Re-engineering Activities and Functional Demonstrations associated with the Offeror Demonstrations performed in response to RFP #N-652-RFP1-0002.

1.2 OVERVIEW

The Government has provided the data necessary to perform the Functional Demonstrations and the Software Re-engineering Activities specified in the Offeror Demonstration Package. This data is to be used without modification by each Offeror, other than those modifications absolutely necessary to allow the Functional Demonstrations and the re-engineering software to execute correctly on the Offeror's hardware and software platform. All manipulation, transfer, and modification of data shall be completely documented by the Offeror as part of the Offeror's submission of the data base implementation in the Unwitnessed Submission Phase II. The Offeror will document how the Government supplied data is used to fulfill the requirements of the FDs and Software Re-engineering Activities.

The data has been constructed as it has for the purpose of providing all Offerors the same baseline data structures and content in order to demonstrate their ability to adhere to Section C of the RFP. The Offerors must not take any action which undermines that purpose.

The data sets can be rearranged to achieve execution of the FDs and Re-engineered Software. The same schema definition must be used for all FDs and the Re-engineered Software. The data may be loaded into the proposed software packages, e.g., DBMS, GIS, etc. Individual data tables may be reordered (sorted) for placement in such packages, but only one copy of each table, regardless of order, may exist on the system under test. Indexes may be added to any field or group of fields as needed. The schema, including indexes created, shall be documented.

The data needed for the Offeror Demonstrations consists of five main types. They are Legal Land Data, Plat Data, Digital Elevation Model (DEM) data, Public Land Survey System (PLSS) Coordinate Computational System (PCCS) data, and Geographic Information System (GIS) data. Each of these types of data is described in a section below. In addition, sections below describe the BLM's data dictionary and the data requirements of the Functional Demonstrations.

Sections 2.0 through 4.0 describe the Legal Land Data and Resource Data required for the Software Re-engineered Activities. Section 5.0 describes the various data required for the FDs.

The data files needed for the Re-engineered Software Activities have been gathered from 31 townships in the northern part of New Mexico. A complete list of these townships is as follows:

Meridian	Township	Ranges
NM Principle	29N	5W, 6W, 7W, 8W, 9W
	28N	5W, 6W, 7W
	27N	5W, 6W, 7W
	26N	6W, 7W
	25N	6W, 7W
	24N	6W, 7W, 8W, 9W
	23N	6W, 7W, 8W, 9W
	22N	6W, 7W, 8W, 9W
	21N	6W, 7W, 8W, 9W

1.3 MEDIA

ODP data will be supplied on standard 1/2" x 2400' 9 track tapes, recorded at 6250 bpi. The tapes are labeled, IBM format and contain EBCDIC character data except as noted below. All data files on each tape are recorded with a common fixed record length and blocking factor. Records of less than the maximum length are padded with blanks. There are a total of 5 tapes in a complete set. Tapes #1-4 contain EBCDIC character data, while tape #5 contains binary data.

Tape #4 contains files in standard USGS Digital Elevation Model (DEM) format. In this format, logical records longer than 1024 characters are broken into 2, 3, or 4 sequential records on the tape. Application programs using this data must recombine the separate records as appropriate.

Tape #5 contains binary data files from the MOSS system as described in Appendix D of the ODP instructions, but with one exception: The first (leftmost) two bytes of each record of these files are not valid data. They are control bytes added to the record as a by product of the utility software which produced the tapes. This is why the record length for this tape is 258 bytes instead of 256.

Summary of tape contents:

Tape #1-	80 char/rec,	100 rec/block;	444 files,	78 mb
Tape #2-	96 char/rec,	100 rec/block;	192 files,	111 mb
Tape #3-	132 char/rec,	50 rec/block;	15 files,	52 mb
Tape #4-	1024 char/rec,	4 rec/block;	10 files,	2 mb
Tape #5-	258 byte/rec,	10 rec/block;	52 files,	7 mb

Detail of tape contents (file names, sizes) is on following pages.

TAPE #1: 9 TRACK, 6250 BPI, LABELED, IBM, EBCDIC, 80 CHAR/REC, 100 REC/BLOCK

The following file is the SQL query file

QRYDESC	329	records	26,320	bytes

The following file is the AIRS data dictionary text

AIRSDED	4071	records	225,680	bytes

The following file is the ALMRS data dictionary text

LTD_DIC	3128	records	250040	bytes

The following files are for re-engineered applications; DLG format

LTD.COUNTIES	2365	records	189280	bytes
CHACO-CANYON-AZ3.HYS03	771	records	61680	bytes
CHACO-CANYON-AZ3.HYS04	733	records	58640	bytes
CHACO-CANYON-AZ3.HYS05	1035	records	82800	bytes
CHACO-CANYON-AZ3.HYS10	895	records	71600	bytes
CHACO-CANYON-AZ3.HYS11	940	records	75200	bytes
CHACO-CANYON-AZ3.HYS12	534	records	42720	bytes
CHACO-CANYON-AZ3.HYS13	1020	records	81600	bytes
CHACO-CANYON-AZ3.HYS18	976	records	78080	bytes
CHACO-CANYON-AZ3.HYS19	1169	records	93520	bytes
CHACO-CANYON-AZ3.HYS20	1107	records	88560	bytes
CHACO-CANYON-AZ3.HYS21	1133	records	90640	bytes
CHACO-CANYON-AZ3.HYS26	843	records	67440	bytes
CHACO-CANYON-AZ3.HYS27	1053	records	84240	bytes
CHACO-CANYON-AZ3.HYS28	979	records	78320	bytes
CHACO-CANYON-AZ3.HYS29	1288	records	103040	bytes
CHACO-MESA.AQ1.HYS02	527	records	42160	bytes
CHACO-MESA.AQ1.HYS03	623	records	49840	bytes
CHACO-MESA.AQ1.HYS04	693	records	55440	bytes
CHACO-MESA.AQ1.HYS05	773	records	61840	bytes
DURANGO-DU3.HYS27	670	records	53600	bytes
DURANGO-DU3.HYS28	1075	records	86000	bytes
DURANGO-DU3.HYS29	1080	records	86400	bytes
DURANGO-DU3.HYS30	575	records	46000	bytes
FARMINGTON.SI2.HYS14	2084	records	166720	bytes
FARMINGTON.SI2.HYS15	2636	records	210880	bytes
FARMINGTON.SI2.HYS16	2916	records	233280	bytes
FARMINGTON.SI2.HYS22	1974	records	157920	bytes
FARMINGTON.SI2.HYS23	3235	records	258800	bytes
FARMINGTON.SI2.HYS24	3906	records	312480	bytes
NAVAJO-RESERVOIR.AZ1.HYS03	603	records	48240	bytes
NAVAJO-RESERVOIR.AZ1.HYS04	963	records	77040	bytes
NAVAJO-RESERVOIR.AZ1.HYS05	1622	records	129760	bytes
NAVAJO-RESERVOIR.AZ1.HYS06	808	records	64640	bytes

```
NAVAJO-RESERVOIR.AZ1.HYS09     762 records      60960 bytes
NAVAJO-RESERVOIR.AZ1.HYS10     595 records      47600 bytes
NAVAJO-RESERVOIR.AZ1.HYS11     857 records      68560 bytes
NAVAJO-RESERVOIR.AZ1.HYS12    1719 records     137520 bytes
NAVAJO-RESERVOIR.AZ1.HYS13     702 records      56160 bytes
NAVAJO-RESERVOIR.AZ1.HYS14     663 records      53040 bytes
NAVAJO-RESERVOIR.AZ1.HYS17    1300 records     104000 bytes
NAVAJO-RESERVOIR.AZ1.HYS18    1453 records     116240 bytes
NAVAJO-RESERVOIR.AZ1.HYS19     821 records      65680 bytes
NAVAJO-RESERVOIR.AZ1.HYS20     688 records      55040 bytes
NAVAJO-RESERVOIR.AZ1.HYS21     750 records      60000 bytes
NAVAJO-RESERVOIR.AZ1.HYS22     672 records      53760 bytes
NAVAJO-RESERVOIR.AZ1.HYS27     812 records      64960 bytes
NAVAJO-RESERVOIR.AZ1.HYS28     619 records      49520 bytes
NAVAJO-RESERVOIR.AZ1.HYS29     698 records      55840 bytes
NAVAJO-RESERVOIR.AZ1.HYS30     729 records      58320 bytes
CHACO-CANYON-AZ3.MTT02         406 records      32480 bytes
CHACO-CANYON-AZ3.RDS03        1639 records     131120 bytes
CHACO-CANYON-AZ3.RDS04        1593 records     127440 bytes
CHACO-CANYON-AZ3.RDS05        2211 records     176880 bytes
CHACO-CANYON-AZ3.RDS10        1158 records      92640 bytes
CHACO-CANYON-AZ3.RDS11         897 records      71760 bytes
CHACO-CANYON-AZ3.RDS12        1717 records     137360 bytes
CHACO-CANYON-AZ3.RDS13        2647 records     211760 bytes
CHACO-CANYON-AZ3.RDS18         813 records      65040 bytes
CHACO-CANYON-AZ3.RDS19        1271 records     101680 bytes
CHACO-CANYON-AZ3.RDS20        1411 records     112880 bytes
CHACO-CANYON-AZ3.RDS21        2155 records     172400 bytes
CHACO-CANYON-AZ3.RDS26        1079 records      86320 bytes
CHACO-CANYON-AZ3.RDS27        1202 records      96160 bytes
CHACO-CANYON-AZ3.RDS28        2058 records     164640 bytes
CHACO-CANYON-AZ3.RDS29        4005 records     320400 bytes
CHACO-CANYON-AZ3.RRT01          37 records       2960 bytes
CHACO-CANYON-AZ3.RRT02          37 records       2960 bytes
CHACO-MESA.AQ1.MTT01           212 records      16960 bytes
CHACO-MESA.AQ1.MTT02           312 records      24960 bytes
CHACO-MESA.AQ1.RDS02           842 records      67360 bytes
CHACO-MESA.AQ1.RDS03          1118 records      89440 bytes
CHACO-MESA.AQ1.RDS04          1290 records     103200 bytes
CHACO-MESA.AQ1.RDS05           920 records      73600 bytes
CHACO-MESA.AQ1.RRT01            36 records       2880 bytes
CHACO-MESA.AQ1.RRT02            36 records       2880 bytes
DURANGO-DU3.MTT01              341 records      27280 bytes
DURANGO-DU3.MTT02               55 records       4400 bytes
DURANGO-DU3.RDS27             2502 records     200160 bytes
DURANGO-DU3.RDS28             2024 records     161920 bytes
DURANGO-DU3.RDS29             1498 records     119840 bytes
DURANGO-DU3.RDS30             1559 records     124720 bytes
DURANGO-DU3.RRT01              201 records      16080 bytes
DURANGO-DU3.RRT02               39 records       3120 bytes
FARMINGTON.SI2.MTT01           394 records      31520 bytes
FARMINGTON.SI2.MTT02           832 records      66560 bytes
FARMINGTON.SI2.RDS14               1442 records     115360 bytes
FARMINGTON.SI2.RDS15               4540 records     363200 bytes
FARMINGTON.SI2.RDS16               3789 records     303120 bytes
FARMINGTON.SI2.RDS22               3179 records     254320 bytes
FARMINGTON.SI2.RDS23               9273 records     741840 bytes
FARMINGTON.SI2.RDS24               2876 records     230080 bytes
FARMINGTON.SI2.RRT01                 37 records       2960 bytes
FARMINGTON.SI2.RRT02                 37 records       2960 bytes
NAVAJO-RESERVOIR.AZ1.MTT01          759 records      60720 bytes
NAVAJO-RESERVOIR.AZ1.MTT02          491 records      39280 bytes
NAVAJO-RESERVOIR.AZ1.RDS03         1345 records     107600 bytes
NAVAJO-RESERVOIR.AZ1.RDS04         1980 records     158400 bytes
NAVAJO-RESERVOIR.AZ1.RDS05         1922 records     153760 bytes
NAVAJO-RESERVOIR.AZ1.RDS06          591 records      47280 bytes
NAVAJO-RESERVOIR.AZ1.RDS09         3006 records     240480 bytes
NAVAJO-RESERVOIR.AZ1.RDS10         2203 records     176240 bytes
NAVAJO-RESERVOIR.AZ1.RDS11         2432 records     194560 bytes
NAVAJO-RESERVOIR.AZ1.RDS12         2449 records     195920 bytes
NAVAJO-RESERVOIR.AZ1.RDS13         2154 records     172320 bytes
NAVAJO-RESERVOIR.AZ1.RDS14         1068 records      85440 bytes
NAVAJO-RESERVOIR.AZ1.RDS17         3132 records     250560 bytes
NAVAJO-RESERVOIR.AZ1.RDS18         2119 records     169520 bytes
NAVAJO-RESERVOIR.AZ1.RDS19         1852 records     148160 bytes
NAVAJO-RESERVOIR.AZ1.RDS20         1307 records     104560 bytes
NAVAJO-RESERVOIR.AZ1.RDS21         2003 records     160240 bytes
NAVAJO-RESERVOIR.AZ1.RDS22         1334 records     106720 bytes
NAVAJO-RESERVOIR.AZ1.RDS27         1618 records     129440 bytes
NAVAJO-RESERVOIR.AZ1.RDS28         1926 records     154080 bytes
NAVAJO-RESERVOIR.AZ1.RDS29         2421 records     193680 bytes
NAVAJO-RESERVOIR.AZ1.RDS30         2112 records     168960 bytes
NAVAJO-RESERVOIR.AZ1.RRT01           37 records       2960 bytes
```

The following files are for re-engineered applications; PCCS format

A21N6W	14 records	1120 bytes
A21N7W	15 records	1200 bytes
A21N8W	6 records	480 bytes
A21N9W	15 records	1200 bytes
A22N6W	1 records	80 bytes
A22N7W	1 records	80 bytes
A22N8W	1 records	80 bytes
A22N9W	1 records	80 bytes
A23N6W	1 records	80 bytes
A23N7W	1 records	80 bytes
A23N8W	1 records	80 bytes
A23N9W	1 records	80 bytes
A24N6W	14 records	1120 bytes
A24N7W	14 records	1120 bytes
A24N8W	13 records	1040 bytes
A24N9W	14 records	1120 bytes
A25N6W	14 records	1120 bytes
A25N7W	14 records	1120 bytes
A26N6W	2 records	160 bytes
A26N7W	1 records	80 bytes
A27N5W	12 records	960 bytes
A27N6W	12 records	960 bytes
A27N7W	8 records	640 bytes
A28N5W	3 records	240 bytes
A28N6W	26 records	2080 bytes
A28N7W	31 records	2480 bytes
A29N10W	20 records	1600 bytes
A29N11W	14 records	1120 bytes
A29N12W	17 records	1360 bytes
A29N5W	23 records	1840 bytes
A29N6W	55 records	4400 bytes
A29N7W	46 records	3680 bytes
A29N8W	25 records	2000 bytes
A29N9W	12 records	960 bytes
A30N10W	1 records	80 bytes
A30N11W	13 records	1040 bytes
A30N5W	24 records	1920 bytes
A30N6W	98 records	7840 bytes
A30N7W	88 records	7040 bytes
A30N8W	40 records	3200 bytes
A30N9W	1 records	80 bytes
A31N5W	20 records	1600 bytes
A31N6W	88 records	7040 bytes
A31N7W	98 records	7840 bytes
A32N5W	25 records	2000 bytes
A32N6W	105 records	8400 bytes
L21N6W	1280 records	102400 bytes
L21N7W	1268 records	101440 bytes
L21N8W	1264 records	101120 bytes

L21N9W	1280	records	102400	bytes
L22N6W	1254	records	100320	bytes
L22N7W	1254	records	100320	bytes
L22N8W	1254	records	100320	bytes
L22N9W	1254	records	100320	bytes
L23N6W	1254	records	100320	bytes
L23N7W	1254	records	100320	bytes
L23N8W	1254	records	100320	bytes
L23N9W	1254	records	100320	bytes
L24N6W	1305	records	104400	bytes
L24N7W	1305	records	104400	bytes
L24N8W	1278	records	102240	bytes
L24N9W	1280	records	102400	bytes
L25N6W	1280	records	102400	bytes
L25N7W	1280	records	102400	bytes
L26N6W	1254	records	100320	bytes
L26N7W	1254	records	100320	bytes
L27N5W	1265	records	101200	bytes
L27N6W	1265	records	101200	bytes
L27N7W	1261	records	100880	bytes
L28N5W	1017	records	81360	bytes
L28N6W	979	records	78320	bytes
L28N7W	987	records	78960	bytes
L29N10W	1293	records	103440	bytes
L29N11W	1343	records	107440	bytes
L29N12W	1275	records	102000	bytes
L29N5W	1279	records	102320	bytes
L29N6W	1355	records	108400	bytes
L29N7W	1307	records	104560	bytes
L29N8W	1302	records	104160	bytes
L29N9W	1276	records	102080	bytes
L30N10W	1254	records	100320	bytes
L30N11W	1266	records	101280	bytes
L30N5W	1278	records	102240	bytes
L30N6W	1383	records	110640	bytes
L30N7W	1391	records	111280	bytes
L30N8W	1358	records	108640	bytes
L30N9W	1254	records	100320	bytes
L31N5W	1186	records	94880	bytes
L31N6W	1290	records	103200	bytes
L31N7W	1305	records	104400	bytes
L32N5W	952	records	76160	bytes
L32N6W	1162	records	92960	bytes
X21N6W	640	records	51200	bytes
X21N7W	641	records	51280	bytes
X21N8W	632	records	50560	bytes
X21N9W	640	records	51200	bytes
X22N6W	627	records	50160	bytes
X22N7W	627	records	50160	bytes
X22N8W	627	records	50160	bytes
X22N9W	627	records	50160	bytes
X23N6W	627	records	50160	bytes

X23N7W	627 records	50160 bytes
X23N8W	627 records	50160 bytes
X23N9W	627 records	50160 bytes
X24N6W	665 records	53200 bytes
X24N7W	665 records	53200 bytes
X24N8W	639 records	51120 bytes
X24N9W	640 records	51200 bytes
X25N6W	640 records	51200 bytes
X25N7W	640 records	51200 bytes
X26N6W	627 records	50160 bytes
X26N7W	627 records	50160 bytes
X27N5W	638 records	51040 bytes
X27N6W	638 records	51040 bytes
X27N7W	634 records	50720 bytes
X28N5W	527 records	42160 bytes
X28N6W	502 records	40160 bytes
X28N7W	510 records	40800 bytes
X29N10W	668 records	53440 bytes
X29N11W	693 records	55440 bytes
X29N12W	644 records	51520 bytes
X29N5W	651 records	52080 bytes
X29N6W	728 records	58240 bytes
X29N7W	675 records	54000 bytes
X29N8W	651 records	52080 bytes
X29N9W	638 records	51040 bytes
X30N10W	627 records	50160 bytes
X30N11W	639 records	51120 bytes
X30N5W	650 records	52000 bytes
X30N6W	763 records	61040 bytes
X30N7W	770 records	61600 bytes
X30N8W	732 records	58560 bytes
X30N9W	627 records	50160 bytes
X31N5W	608 records	48640 bytes
X31N6W	687 records	54960 bytes
X31N7W	701 records	56080 bytes
X32N5W	488 records	39040 bytes
X32N6W	634 records	50720 bytes

The following files are for re-engineered applications; LLD format

N10NW23	4335 records	346800 bytes
N11NW23	3270 records	261600 bytes
N12NW23	4119 records	329520 bytes
N13NW23	3213 records	257040 bytes
N14NW23	2620 records	209600 bytes
N15NW23	2482 records	198560 bytes
N16NW23	2660 records	212800 bytes
N17NW23	2961 records	236880 bytes
N18NW23	2581 records	206480 bytes
N19NW23	3264 records	261120 bytes
N1NW23	3493 records	279440 bytes
N20NW23	2385 records	190800 bytes
N21NW23	2141 records	171280 bytes
N2NW23	3060 records	244800 bytes
N3NW23	3772 records	301760 bytes
N4NW23	3456 records	276480 bytes
N5NW23	3008 records	240640 bytes
N6NW23	3467 records	277360 bytes
N7NW23	3870 records	309600 bytes
N8NW23	3501 records	280080 bytes
N9NW23	4200 records	336000 bytes

The following files are FORTRAN source code for FD22

ADJL0.F77	17 records	1360 bytes
AL010.F77	71 records	5680 bytes
AL290.F77	82 records	6560 bytes
DEGPAK.F77	39 records	3120 bytes
DMSP0.F77	18 records	1440 bytes
DRIVE0.F77	175 records	14000 bytes
E0FN0.F77	15 records	1200 bytes
E1FN0.F77	16 records	1280 bytes
E2FN0.F77	15 records	1200 bytes
E3FN0.F77	16 records	1280 bytes
ELIPSE.F77	54 records	4320 bytes
GTDEF.F77	144 records	11520 bytes
GTP00.F77	355 records	28400 bytes
GTRAN.F77	137 records	10960 bytes
GTRBD.F77	40 records	3200 bytes
GTRBD1.F77	554 records	44320 bytes
GTRBD2.F77	556 records	44480 bytes
GTRBD3.F77	547 records	43760 bytes
GTRIF.F77	115 records	9200 bytes
GTRN0.F77	308 records	24640 bytes
GTSET.F77	137 records	10960 bytes
IS010.F77	114 records	9120 bytes
IS020.F77	86 records	6880 bytes
IS030.F77	119 records	9520 bytes
IS040.F77	115 records	9200 bytes
IS050.F77	88 records	7040 bytes
IS060.F77	99 records	7920 bytes
IS070.F77	94 records	7520 bytes
IS080.F77	140 records	11200 bytes
IS090.F77	112 records	8960 bytes
IS100.F77	70 records	5600 bytes
IS110.F77	69 records	5520 bytes
IS120.F77	69 records	5520 bytes
IS130.F77	70 records	5600 bytes
IS140.F77	70 records	5600 bytes
IS150.F77	74 records	5920 bytes
IS160.F77	65 records	5200 bytes
IS170.F77	67 records	5360 bytes
IS180.F77	64 records	5120 bytes
IS190.F77	66 records	5280 bytes
IS1A0.F77	126 records	10080 bytes
IS200.F77	167 records	13360 bytes
MLFN0.F77	14 records	1120 bytes
MSFN0.F77	15 records	1200 bytes
PAKD0.F77	25 records	2000 bytes
PAKPAR.F77	50 records	4000 bytes
PAKR0.F77	20 records	1600 bytes
PAKS0.F77	51 records	4080 bytes
PF010.F77	78 records	6240 bytes
PF020.F77	129 records	10320 bytes

PF030.F77	50 records	4000 bytes
PF040.F77	59 records	4720 bytes
PF050.F77	53 records	4240 bytes
PF060.F77	52 records	4160 bytes
PF070.F77	53 records	4240 bytes
PF080.F77	48 records	3840 bytes
PF090.F77	78 records	6240 bytes
PF100.F77	57 records	4560 bytes
PF110.F77	57 records	4560 bytes
PF120.F77	61 records	4880 bytes
PF130.F77	56 records	4480 bytes
PF140.F77	56 records	4480 bytes
PF150.F77	56 records	4480 bytes
PF160.F77	45 records	3600 bytes
PF170.F77	45 records	3600 bytes
PF180.F77	44 records	3520 bytes
PF190.F77	70 records	5600 bytes
PF1A0.F77	87 records	6960 bytes
PF200.F77	71 records	5680 bytes
PHI10.F77	44 records	3520 bytes
PHI20.F77	39 records	3120 bytes
PHI30.F77	36 records	2880 bytes
PHI40.F77	48 records	3840 bytes
PI010.F77	97 records	7760 bytes
PI020.F77	135 records	10800 bytes
PI030.F77	63 records	5040 bytes
PI040.F77	60 records	4800 bytes
PI050.F77	54 records	4320 bytes
PI060.F77	59 records	4720 bytes
PI070.F77	56 records	4480 bytes
PI080.F77	56 records	4480 bytes
PI090.F77	97 records	7760 bytes
PI100.F77	67 records	5360 bytes
PI110.F77	71 records	5680 bytes
PI120.F77	69 records	5520 bytes
PI130.F77	64 records	5120 bytes
PI140.F77	70 records	5600 bytes
PI150.F77	77 records	6160 bytes
PI160.F77	57 records	4560 bytes
PI170.F77	53 records	4240 bytes
PI180.F77	46 records	3680 bytes
PI190.F77	123 records	9840 bytes
PI1A0.F77	104 records	8320 bytes
PI200.F77	65 records	5200 bytes
PROIN.F77	431 records	34480 bytes
PROVW.F77	375 records	30000 bytes
QSFN0.F77	20 records	1600 bytes
RADD0.F77	44 records	3520 bytes
SELELP.F77	50 records	4000 bytes
SPHD0.F77	103 records	8240 bytes
TRANSFORM.F77	180 records	14400 bytes
TSFN0.F77	18 records	1440 bytes

```
UNTF0.F77                    45 records        3600 bytes
ZONE0.F77                    97 records        7760 bytes
```

The following files are for various functional demos:

MBDESC	24 records	1920 bytes
J22N6W.IN	200 records	16000 bytes
J22N7W.IN	200 records	16000 bytes
J22N8W.IN	201 records	16080 bytes
IBMTST1.F77	94 records	7520 bytes
IBMTST4.F77	94 records	7520 bytes
PRECIS.F77	43 records	3440 bytes
FILE3	10 records	800 bytes
LATLON.DAT	1018 records	81440 bytes
STPF.DAT	1018 records	81440 bytes
UTM.DAT	1018 records	81440 bytes
PHYSIO.EX	195842 records	15667360 bytes
COUNTY.EX	91332 records	7306560 bytes
COUNTY.DAT	3090 records	247200 bytes
TC01A.EX	366 records	29280 bytes
TC01B.EX	366 records	29280 bytes
TC02A.EX	639 records	51120 bytes
TC02B.EX	639 records	51120 bytes
TC03A.EX	12 records	960 bytes
TC03B.EX	12 records	960 bytes
TC04A.EX	45 records	3600 bytes
TC04B.EX	45 records	3600 bytes
TC05A.EX	12 records	960 bytes
TC05B.EX	16 records	1280 bytes
TC06A.EX	878 records	70240 bytes
TC06B.EX	12 records	960 bytes
TC07A.EX	76 records	6080 bytes
TC07B.EX	52 records	4160 bytes
TC08A.EX	100 records	8000 bytes
TC08B.EX	98 records	7840 bytes
TC09A.EX	100 records	8000 bytes
TC09B.EX	98 records	7840 bytes
TC10A.EX	18 records	1440 bytes
TC10B.EX	18 records	1440 bytes
TC11A.EX	20 records	1600 bytes
TC11B.EX	3 records	240 bytes
TC12A.EX	20 records	1600 bytes
TC12B.EX	30 records	2400 bytes
TC13A.EX	110 records	8800 bytes
TC13B.EX	110 records	8800 bytes
TC14A.EX	95 records	7600 bytes
TC15.EX	111 records	8880 bytes
TC16.EX	22 records	1760 bytes
TC17.EX	141 records	11280 bytes
TC18.EX	878 records	70240 bytes
CARCYN.EX	32952 records	2636160 bytes
FAULT.EX	8 records	640 bytes
BTESTRL.EX	841 records	67280 bytes
MATT.S.EX	242 records	19360 bytes
SCTSAGEHL.EX	120144 records	9611520 bytes

```
SCTWOLFRG.EX                  74600 records   5968000 bytes
MDRWOLFRG.EX                    745 records     59600 bytes
D_SD_FLAT.DAT                   292 records     23360 bytes
RASTER1.EX                    44583 records   3566640 bytes
RASTER2.EX                    44583 records   3566640 bytes
RASTER3.EX                    10496 records    839680 bytes
RASTER4.EX                    10496 records    839680 bytes
RASTER1.DAT                      42 records      3360 bytes
RASTER2.DAT                      61 records      4880 bytes
RASTER3.DAT                      45 records      3600 bytes
RASTER4.DAT                      45 records      3600 bytes

*** GRAND TOTAL:             976347 RECORDS  78107760 BYTES
444 TOTAL FILES
```

TAPE #2: 9 TRACK, 6250 BPI, LABELED, IBM, EBCDIC, 96 CHAR/RECORD, 100 REC/BLOCK

The following files are for re-engineered applications; Status, Mining Claims, and Case Recordation. NOTE: Some of these files are "placeholders" and contain only a blank line.

ST1.16	6254 records	600384 bytes
ST1.25	4 records	384 bytes
ST10.16	5888 records	565248 bytes
ST10.25	70 records	6720 bytes
ST11.16	6450 records	619200 bytes
ST11.25	1 records	96 bytes
ST12.16	6297 records	604512 bytes
ST12.25	10 records	960 bytes
ST13.16	5209 records	500064 bytes
ST13.25	1 records	96 bytes
ST14.16	3646 records	350016 bytes
ST14.25	1 records	96 bytes
ST15.16	3590 records	344640 bytes
ST15.25	1 records	96 bytes
ST16.16	3237 records	310752 bytes
ST16.25	12 records	1152 bytes
ST17.16	3511 records	337056 bytes
ST17.25	13 records	1248 bytes
ST18.16	3195 records	306720 bytes
ST18.25	1 records	96 bytes
ST19.16	4062 records	389952 bytes
ST19.25	1 records	96 bytes
ST2.16	4747 records	455712 bytes
ST2.25	5 records	480 bytes
ST20.16	3283 records	315168 bytes
ST20.25	1 records	96 bytes
ST21.16	1956 records	187776 bytes
ST21.25	1 records	96 bytes
ST3.16	5357 records	514272 bytes
ST3.25	1 records	96 bytes
ST4.16	5503 records	528288 bytes
ST4.25	1 records	96 bytes
ST5.16	4434 records	425664 bytes
ST5.25	1 records	96 bytes
ST6.16	5229 records	501984 bytes
ST6.25	7 records	672 bytes
ST7.16	5901 records	566496 bytes
ST7.25	4 records	384 bytes
ST8.16	4833 records	463968 bytes
ST8.25	2 records	192 bytes
ST9.16	5500 records	528000 bytes
ST9.25	29 records	2784 bytes
STNW.FOUR	12443 records	1194528 bytes
STNW.SIX	6101 records	585696 bytes
STNW.THREE	2881 records	276576 bytes

```
MC.FOUR                     302023 records  28994208 bytes
CR1.16                        3260 records    312960 bytes
CR1.25                         292 records     28032 bytes
CR10.16                       9582 records    919872 bytes
CR10.25                        681 records     65376 bytes
CR11.16                       6226 records    597696 bytes
CR11.25                        692 records     66432 bytes
CR12.16                       5908 records    567168 bytes
CR12.25                        838 records     80448 bytes
CR13.16                       4506 records    432576 bytes
CR13.25                        574 records     55104 bytes
CR14.16                       1407 records    135072 bytes
CR14.25                        126 records     12096 bytes
CR15.16                       1136 records    109056 bytes
CR15.25                        131 records     12576 bytes
CR16.16                       1243 records    119328 bytes
CR16.25                        133 records     12768 bytes
CR17.16                       1138 records    109248 bytes
CR17.25                         86 records      8256 bytes
CR18.16                        708 records     67968 bytes
CR18.25                         75 records      7200 bytes
CR19.16                        942 records     90432 bytes
CR19.25                         72 records      6912 bytes
CR2.16                        2299 records    220704 bytes
CR2.25                         257 records     24672 bytes
CR20.16                        837 records     80352 bytes
CR20.25                         74 records      7104 bytes
CR21.16                        409 records     39264 bytes
CR21.25                          7 records       672 bytes
CR3.16                        2705 records    259680 bytes
CR3.25                         215 records     20640 bytes
CR4.16                        2587 records    248352 bytes
CR4.25                         170 records     16320 bytes
CR5.16                        3628 records    348288 bytes
CR5.25                         237 records     22752 bytes
CR6.16                        5908 records    567168 bytes
CR6.25                         558 records     53568 bytes
CR7.16                        6767 records    649632 bytes
CR7.25                         570 records     54720 bytes
CR8.16                        6660 records    639360 bytes
CR8.25                         640 records     61440 bytes
CR9.16                        7832 records    751872 bytes
CR9.25                         794 records     76224 bytes
CRNW.SIX                     17407 records   1671072 bytes
CRNW.THREE                       1 records        96 bytes
```

The following files are for functional demos; ADS format

EH33117.TRANSP.L	272772 records	26186112 bytes
AD34117.TRANSP.L	243162 records	23343552 bytes
EH33117.TRANSP.L.F	84001 records	8064096 bytes
C843114.SOILS.L	5799 records	556704 bytes
C743114.SOILS.L	5517 records	529632 bytes
C643114.SOILS.L	4430 records	425280 bytes
KIMCOM.LANDLI.L	3292 records	316032 bytes
LAJUNM.LANDLI.L	2717 records	260832 bytes
D743114.SOILS.L	2626 records	252096 bytes
B743114.SOILS.L	2268 records	217728 bytes
SPRNGM.LANDLI.L	1656 records	158976 bytes
KIMCOM.LANDLI.A.F	1121 records	107616 bytes
KIMCOM.LANDLI.A	1089 records	104544 bytes
TWOBTM.LANDLI.L	1068 records	102528 bytes
LAJUNM.LANDLI.A.F	894 records	85824 bytes
LAJUNM.LANDLI.A	870 records	83520 bytes
SPRNGM.LANDLI.A	628 records	60288 bytes
TWOBTM.LANDLI.A.F	409 records	39264 bytes
TWOBTM.LANDLI.A	407 records	39072 bytes
DLG7.LANDLI.L	405 records	38880 bytes
DLG5.LANDLI.L	414 records	39744 bytes
DLG4.LANDLI.L	395 records	37920 bytes
DLG1.LANDLI.L	348 records	33408 bytes
MONTANA.TRANSP.L	86 records	8256 bytes
MONTANA.BORDER	72 records	6912 bytes
IDAHO.BORDER	72 records	6912 bytes
DLG7.LANDLI.A	83 records	7968 bytes
DLG5.LANDLI.A	86 records	8256 bytes
DLG4.LANDLI.A	81 records	7776 bytes
DLG1.LANDLI.A	73 records	7008 bytes
IDAHO.TRANSP.L	64 records	6144 bytes
TRANSPORTATION	47 records	4512 bytes
LANDLINES	49 records	4704 bytes
TWOBTM.MENUS	2 records	192 bytes
TWOBTM.LANDLI.S.F	1 records	96 bytes
TWOBTM.LANDLI.S	1 records	96 bytes
TWOBTM.LANDLI.L.F	1 records	96 bytes
TWOBTM.BORDER	5 records	480 bytes
SPRNGM.MENUS	2 records	192 bytes
SPRNGM.LANDLI.L.F	1 records	96 bytes
SPRNGM.BORDER	2 records	192 bytes
SOILS	34 records	3264 bytes
MONTANA.TRANSP.L.F	1 records	96 bytes
MONTANA.MENUS	2 records	192 bytes
LAJUNM.MENUS	2 records	192 bytes
LAJUNM.LANDLI.L.F	1 records	96 bytes
LAJUNM.BORDER	5 records	480 bytes
KIMCOM.MENUS	2 records	192 bytes
KIMCOM.LANDLI.L.F	1 records	96 bytes
KIMCOM.BORDER	5 records	480 bytes

```
IDAHO.TRANSP.L.F                    1 records         96 bytes
IDAHO.MENUS                         2 records        192 bytes
EH33117.MENUS                       5 records        480 bytes
EH33117.BORDER                     16 records       1536 bytes
DLG7.MENUS                          5 records        480 bytes
DLG7.LANDLI.L.F                     1 records         96 bytes
DLG7.LANDLI.A.F                     1 records         96 bytes
DLG7.BORDER                         2 records        192 bytes
DLG5.MENUS                          2 records        192 bytes
DLG5.LANDLI.L.F                     1 records         96 bytes
DLG5.BORDER                         2 records        192 bytes
DLG4.MENUS                          2 records        192 bytes
DLG4.BORDER                         2 records        192 bytes
DLG1.MENUS                          2 records        192 bytes
DLG1.LANDLI.L.F                     1 records         96 bytes
DLG1.BORDER                         2 records        192 bytes
D743114.SOILS.L.F                   1 records         96 bytes
D743114.MENUS                       8 records        768 bytes
D743114.BORDER                      2 records        192 bytes
C843114.SOILS.L.F                   1 records         96 bytes
C843114.MENUS                       5 records        480 bytes
C843114.BORDER                      2 records        192 bytes
C743114.SOILS.L.F                   1 records         96 bytes
C743114.MENUS                       6 records        576 bytes
C743114.BORDER                      2 records        192 bytes
C643114.SOILS.L.F                   1 records         96 bytes
C643114.MENUS                       7 records        672 bytes
C643114.BORDER                      2 records        192 bytes
B743114.SOILS.L.F                   1 records         96 bytes
B743114.MENUS                       8 records        768 bytes
B743114.BORDER                      2 records        192 bytes
ADS.TWOBTM                         22 records       2112 bytes
ADS.SPRNGM                         22 records       2112 bytes
ADS.MONTANA                        22 records       2112 bytes
ADS.LAJUNM                         22 records       2112 bytes
ADS.KIMCOM                         22 records       2112 bytes
ADS.IDAHO                          22 records       2112 bytes
ADS.EH33117                        22 records       2112 bytes
ADS.DLG7                           22 records       2112 bytes
ADS.DLG5                           22 records       2112 bytes
ADS.DLG4                           22 records       2112 bytes
ADS.DLG1                           22 records       2112 bytes
ADS.D743114                        21 records       2016 bytes
ADS.C843114                        21 records       2016 bytes
ADS.C743114                        21 records       2016 bytes
ADS.C643114                        21 records       2016 bytes
ADS.B743114                        21 records       2016 bytes
ADS.AD34117                        22 records       2112 bytes
AD34117.TRANSP.L.F                  1 records         96 bytes
AD34117.MENUS                       5 records        480 bytes
AD34117.BORDER                     16 records       1536 bytes
SPRNGM.LANDLI.A.F                 649 records      62304 bytes

*** GRAND TOTAL:              1160220 RECORDS 111381120 BYTES
192 TOTAL FILES
```

TAPE #3: 9 TRACK, 6250 BPI, LABELED, IBM, EBCDIC, 132 CHAR/REC, 50 REC/BLOCK

The following files are for functional demos; ADS format

ADS.CHACO	22 records	2904 bytes
CHACO.BORDER	2 records	264 bytes
CHACO.MENUS	2 records	264 bytes
CHACO.OWNERS.A	19 records	2508 bytes
CHACO.OWNERS.A.F	19 records	2508 bytes
CHACO.OWNERS.L	39 records	5148 bytes
CHACO.OWNERS.L.F	1 records	132 bytes
OWNERSHIP	41 records	5412 bytes

The following files are for re-engineered applications; Status, Mining Claims, and Case Recordation

STNW.FIVE	11901 records	1570932 bytes
STNW.TWO	11693 records	1543476 bytes
MC.FIVE	77193 records	10189476 bytes
CRNW.FIVE	24936 records	3291552 bytes
CRNW.TWO	18548 records	2448336 bytes
CRNW.FOUR	247692 records	32695344 bytes

The following file is for functional demos

MATT.S.DAT	245 records	32340 bytes
** GRAND TOTAL:	392353 RECORDS	51790596 BYTES
15 TOTAL FILES		

TAPE #4: 9 TRACK, 6250 BPI, LABELED, IBM, EBCDIC, 1024 CHAR/REC, 4 REC/BLOCK

The following files are data table formats from the Automated Inspection and Recordation System (AIRS):

ACL.DAT	6 records	6144 bytes
FAC.DAT	8 records	8192 bytes
HDR.DAT	6 records	6144 bytes
IHI.DAT	23 records	23552 bytes
INC.DAT	10 records	10240 bytes
IPR.DAT	23 records	23552 bytes
IRM.DAT	11 records	11264 bytes
WEL.DAT	17 records	17408 bytes

The following files are for re-engineered applications and/or FD's; Digital Elevation Model (DEM) format

AZTEC.SE	1131 records	1159168 bytes
CARRACAS.CANYON	1126 records	1153024 bytes
*** GRAND TOTAL	2361 RECORDS	2417664 BYTES
10 TOTAL FILES		

TAPE #5: 9 TRACK, 6250 BPI, LABELED, IBM, EBCDIC (BINARY), 258 BYTE/REC, 10 REC/BLOCK

The following files are MOSS system binary files for various FD's

B.TESTRL	81 records	20898 bytes
COUNTY_USA	7508 records	1937064 bytes
COUNTY_USA.AT	447 records	115326 bytes
MATT.S	297 records	76626 bytes
MATT.S.AT	237 records	61146 bytes
MDRWOLFRG	36 records	9288 bytes
PHYSIO_USA	9866 records	2545428 bytes
RASTER1.CD	352 records	90816 bytes
RASTER1.CV	2 records	516 bytes
RASTER1.HD	2 records	516 bytes
RASTER2.CD	352 records	90816 bytes
RASTER2.CV	2 records	516 bytes
RASTER2.HD	2 records	516 bytes
RASTER3.CD	96 records	24768 bytes
RASTER3.CV	2 records	516 bytes
RASTER3.HD	2 records	516 bytes
RASTER4.CD	96 records	24768 bytes
RASTER4.CV	2 records	516 bytes
RASTER4.HD	2 records	516 bytes
SCTSAGEHL	5364 records	1383912 bytes
SCTWOLFRG	3161 records	815538 bytes
TC01A	24 records	6192 bytes
TC01B	24 records	6192 bytes
TC02A	32 records	8256 bytes
TC02B	32 records	8256 bytes
TC03A	8 records	2064 bytes
TC03B	10 records	2580 bytes
TC04A	10 records	2580 bytes
TC04B	10 records	2580 bytes
TC05A	8 records	2322 bytes
TC05B	10 records	2580 bytes
TC06A	36 records	9288 bytes
TC06B	10 records	2580 bytes
TC07A	22 records	5676 bytes
TC07B	12 records	3096 bytes
TC08A	38 records	9804 bytes
TC08B	38 records	9804 bytes
TC09A	38 records	9804 bytes
TC09B	38 records	9804 bytes
TC10A	8 records	2064 bytes
TC10B	8 records	2064 bytes
TC11A	11 records	2838 bytes
TC11B	5 records	1290 bytes
TC12A	11 records	2838 bytes
TC12B	50 records	12900 bytes
TC13A	13 records	3354 bytes
TC13B	13 records	3354 bytes

```
TC14A                            14 records       3612 bytes
TC15                              8 records       2064 bytes
TC16                              5 records       1290 bytes
TC17                             11 records       2838 bytes
TC18                             34 records       8772 bytes

*** GRAND TOTAL               28500 RECORDS    7353000 BYTES
52 TOTAL FILES
```

2.0 LEGAL LAND DATA

Legal Land Data consists of data in the following two formats.

a. Legal Land Description (LLD) Data
b. Case Data

The LLD Data consists of one data set containing records all of the same format. (Please note that the acronym LLD stands for Legal Land Description, which is only one component of Legal Land Data, which is not abbreviated LLD).

The Case Data consists of the following three types of data:

a. Current Status Data
b. Case Recordation Data
c. Mining Claims Data

Each of the three types of data consists of records which are of six different record types. The record types are as follows:

a. Case Lands Data
b. Case Data
c. Supplemental Case Data
d. Action Data
e. Name and Address
f. General Remarks

In the following record descriptions, the fields are listed in the order in which they appear in the file. The first field description for each new record begins in column one. There are no field separators used to separate fields and each record consists of 80 characters.

2.1 LEGAL LAND DESCRIPTION (LLD) DATA

2.1.1 Overview of LLD Data

The Legal Land Description data file contains the legal land information about a plot of land.

2.1.2 File Format of LLD Data

The LLD data file contains only one record type in the following format:

Field Name	Starting Column	Ending Column	Field Type
meridian	7	8	alphanumeric
range	9	13	alphanumeric
township	14	18	alphanumeric
section	19	22	alphanumeric
survey_type	23	23	alphanumeric
survey_num	24	28	alphanumeric
survey_suffix	29	30	alphanumeric
aliquot	31	46	alphanumeric
acres	47	54	numeric
survey_note	55	55	alpha
state	56	57	alphanumeric
county_code	58	60	numeric
congress_district	61	62	numeric
district	63	64	numeric
resource_area	65	66	numeric
planning_unit	67	68	numeric
admin_agency	69	76	alphanumeric

Please refer to section 6.6.3 in the Status Coding Handbook located in the BLM Vendor Reference Library, for a detailed description of the LLD fields.

2.1.3 **Filenames of LLD Data**

The Legal Land Description data filenames are as follows:

N1NW23
N3NW23
N5NW23
N7NW23
N9NW23
N11NW23
N13NW23
N15NW23
N17NW23
N19NW23
N21NW23
N2NW23
N4NW23
N6NW23
N8NW23
N10NW23
N12NW23
N14NW23
N16NW23
N18NW23
N20NW23

2.2 CASE DATA

2.2.1 Overview of Case Data

There are three types of Case Data (Current Status, Case Recordation, and Mining Claims). The remainder of this Section will describe the contents and the record formats of these data files.

Each Case data file can consist of six different record types. The record_num field contains a number from one to six which identifies the record type. The record types with their corresponding record_num fields are as follows:

RECORD_NUM	RECORD TYPE
1	case lands
2	case data
3	supplemental case data
4	action data
5	name and address
6	general remarks

Each Case data file must contain the following four record types for each case; case lands, case data, action data, and name and address. There can be multiple records for a case in the following record types; case lands, supplemental case data, action data, name and address, and general remarks.

The serial number field is unique to each case. It is a common field in all six record types and is used to link the record types to one another. In the case data record type in the Case Recordation data file, the serial_case_pt_num field does not relate to case parting. Instead, it represents a suffix which identifies those cases resulting from the division of an original case into multiple, separate cases. In Case Recordation, the serial number field is 15 characters. When converted to status format, it is expanded to 17 characters, and the last two positions (serial_case_pt_num field) are space-filled. When the first position of the section field contains a 7, that 7 is moved to the first position of the serial_case_pt_num field, and the first position of the section field is converted back to a zero to insure conformity with the enhanced status data format.

There will be two types of Case Lands Data records, 1.16 and 1.25. In 1.16 format the aliquot part field is 16 characters long, with the next 9 spaces blank. The aliquot part field will contain a string of 'X''s and spaces. The explanation of these 'X''s can be found in the User's Guide for V Forms Legal Land Description Manual, section 6.3.3, located in the BLM Vendor Reference Library.

The 1.25 format is exactly the same as 1.16, except the aliquot part field and the 9 spaces have been combined to form one 25 character subdivisions field. The subdivisions field will contain a descriptive message describing an area of land.

Again, in the following record descriptions, the fields are listed in the order in which they appear in the file. The first field description for each new record will begin in column one. There are no field separators used to separate fields.

2.2.1.1 Current Status Overview

Current Status data contains ownership information of individual areas of land. Each case describes a particular geographic location. The fields used to uniquely identify an area of land are meridian, township, range, section, survey type, survey number, and survey suffix location.

Please refer to the Status Coding Handbook located in the BLM Vendor Reference Library, for a detailed description of the following record types: case data, supplemental case data, action data, name and address, and general remarks. The case lands record type is in Enhanced Status format. This format adds the geopolitical fields from the LLD records to each case land record. These fields are county, congress_dist, blm_district, resource_area, resource_pl_unit, and admin_agency.

2.2.1.2 Case Recordation Overview

The Case Recordation data file contains current individual case information about individual areas of land. All current uses of the land are tracked, except mining claims. New applications for land usage are also recorded. For example, a case may contain use information such as the following:

- who has the use of a sanitary land fill
- who has leased the minerals
- who has the use of a right of way

Please refer to the Case Recordation Users Guide located in the BLM Vendor Reference Library, for a detailed description of the following record types: case data, supplemental case data, action data, name and address, and general remarks. The case lands record type is in enhanced status format. This format adds the geopolitical fields from the LLD records to each case land record. These fields are county, congress_dist, blm_district, resource_area, resource_pl_unit, and admin_agency.

2.2.1.3 Mining Claims Overview

Mining Claims data contains case information on all recorded mining claims.

Please refer to the Automated Mining Claim Recordation System Users Guide located in the BLM Vendor Reference Library, for a detailed description of the following record types: case data, supplemental case data, action data, name and address, and general remarks. The case lands record type is in enhanced status format. This format adds the geopolitical fields from the LLD records to each case land record. These fields are county, congress_dist, blm_district, resource_area, resource_pl_unit, and admin_agency.

2.2.2 File Formats of Case Data

Please refer to Exhibit D-2 for the data file formats of Case Data.

2.2.3 Filenames of Case Data

Please refer to Exhibit D-3 for the a list of the filenames for Current Status, Case Recordation, and Mining Claims data sets.

3.0 PLAT DATA

Plat data consists of three data types, Plat theme data, Digital Elevation Models, and PLSS Coordinate Computational System (PCCS) data. The remaining Plat themes are in the USGS optional 3 DLG data standard. The Digital Elevation Model (DEM) files are in USGS DEM 7.5 minute data standard. The PCCS data file formats are unique to BLM and are described below in

Section 3.3.

3.1 PLAT THEMES

3.1.1 Overview of Plat Themes

The following Plat themes shall be used in the Software Re-engineering Activities of the Offeror Demonstration:

- Transportation
- Hydrography
- Political Boundaries

The data files for these themes contain information on the same townships listed in section 1.2 of this Appendix.

3.1.2 File Formats of Plat Theme Data

Transportation, Hydrography, and Political Boundaries are in the USGS Optional 3 DLG data standard. Please refer to the US GeoData, Digital Line Graphs from 1:24,000 - Scale Maps, Data Users Guide and the US GeoData, Digital Line Graphs from 1:2,000,000 - Scale Maps, Data Users Guide provided with this ODP document.

The CATEGORY_NAME field in the Data Category Identification record stores the name of the Plat theme of the current DLG file.

3.1.3 Filenames of Plat Theme Data

Please refer to Exhibit D-4 for the list of Plat data file names.

3.2 DIGITAL ELEVATION MODEL (DEM) DATA

3.2.1 Overview of DEM Data

The DEM data files will contain data on the same townships listed in section 1.2 of this Appendix.

3.2.2 File Formats of DEM Data

These data files will be in 7.5 minute USGS Digital Elevation Model standard. Please refer to the US GeoData Digital Elevation Models Data Users Guide provided with this ODP document.

3.2.3 Filenames of DEM Data

Please refer to Exhibit D-5 for the list of DEM data filenames.

3.3 PCCS DATA

3.3.1 Overview of PCCS Data

The PLSS Coordinate Computational System (PCCS) data files contain the physical coordinates needed to map Legal Land Descriptions. There are a total of three different data files for each township. These data file types are as follows:

- A
- L
- X

The PCCS has been developed to (1) compute the geographic coordinates of PLSS corners using official cadastral survey record data; (2) provide an estimate of the approximate relative position coordinate dependability of the computed coordinates; (3) store the survey measurement data and computed coordinates in a database that can be easily accessed; (4) provide data format flexibility to facilitate data transfer to other systems which require computed coordinates of PLSS corners; and (5) utilize equipment which is readily available throughout BLM. Please refer to Appendix A of the GCDB RFP, located in the BLM Vendor Reference Library, for further PCCS data file information.

3.3.2 File Formats of PCCS Data

Please refer to Exhibit D-6 for the file formats of the PCCS data files.

3.3.3 Filenames of PCCS Data

Please refer to Exhibit D-19 for the PCCS data filenames.

4.0 DATA DICTIONARY FILE FORMAT

The Data Dictionary will contain field information on Legal Land Data fields. The Data Dictionary will be a text file named LTD_DIC. Please refer to the Vendor Reference Library for the Data Dictionary file format and the complete Data Dictionary listing.

5.0 FUNCTIONAL DEMONSTRATION DATA REQUIREMENTS

This section describes the data required for the various Functional Demonstrations specified in Appendix C.

5.1 DISTRIBUTED FILE SYSTEM CAPABILITIES DATA FILES

The fielded sequential ASCII data file, FD1INPUT, will consist of 10,000 randomly ordered records, each record will be on a newline separated by a carriage return/newline character. Each record will have the following format:

Field Name	Start	End	Field Type
field1	1	6	integer
order1	7	12	integer
text1	13	32	alphanumeric
text2	33	52	alphanumeric
order2	53	58	integer

5.2 RESERVED

5.3 RDBMS DISTRIBUTION DATA REQUIREMENTS

The fielded sequential ASCII data files, DRFile1, DRFile2, DRFile3, DRFile4, and DRFile5, will each consist of 10 randomly ordered records. Each record will be on a newline separated by a carriage return/newline character. Each file will consist of records with the following format:

Field Name	Starting Column	Ending Column	Field Type
num_link	1	6	integer
field1	7	12	integer

The tables MPB-AMag, MPB-BMag, MPB-AOpt, MPB-Bopt, and WA-AMag will have the same record layouts. Each table will contain the following fields, num_link, Field1, and Field2. The num_link and Field1 fields have integer data types. The Offeror will select a data type for Field2.

5.4 OFFICE AUTOMATION DATA REQUIREMENTS

There are three data files needed for this FD. They are to be created by the Offeror in accordance with the instructions in this section. The first file is a Lotus 1-2-3 format file called OATEST.WKS with the following format:

Cell	Contents
A1	.05
B1	.15
C1	.8
D2	Formula specifying that the value of this cell should equal the value of the cell in the A column of this row multiplied by the value of cell A1, plus the value of the cell in the B column of this row multiplied by the value of cell B1, plus the value of cell in the C column of this row multiplied by the value of cell C1.

The second file is a standard ASCII text file OATEST.ASC with the following format:

```
1    |0   |0   |0
2    |1   |0   |0
3    |0   |1   |0
4    |1   |.5  |0
5    |2   |1   |0
6    |1   |2   |0
7    |1.5 |2.5 |0
8    |3   |1.5 |0
9    |1   |4   |0
10   |2.5 |4   |0
```

The "|" character is used as a field delimiter.

The contents of the third file, an ASCII text file OATEST.DOC, is displayed below:

> SYSTEMATIC ERRORS IN OBSERVATIONS
>
> Due to the properties of the experimental apparatus, systematic errors are introduced into the observations. These errors become larger with each trial unless the apparatus is reset.
>
> Careful recalibration of the apparatus has allowed us to derive empirically a correction formula. When this formula is applied to the result, the systematic errors are eliminated.

Here, you see the result of applying the formula to a specific sequence of observations.

(Enter spreadsheet here)

Note that when the result is plotted, it exhibits the expected behavior.

(Enter graph here.)

5.5 RESERVED

5.6 RESERVED

5.7 SECURITY

No input data files are required for this functional demonstration.

5.8 LANGUAGE INTEGRATION

The following ASCII data, to be created by the Offeror, will be loaded into the proposed database management system.

```
17384|9065
21009|893
```

The "|" character is used as a field delimiter.

5.9 NETWORK INTEGRATION

All data required by the programs described in the scripts shall be provided by the Offeror.

5.10 SYSTEM ADMINISTRATION DATA REQUIREMENTS

The data shall be supplied by the Offeror.

5.11 BACKUP AND RESTORE DATA REQUIREMENTS

The ASCII text file, TEXT, consisting of the following lines, shall be created by the Offeror.

```
    Gloria sic transit mundi.
    The first shall be last and the last shall be
first.
```

5.12 RESERVED

5.13 CPU PRECISION TEST DATA REQUIREMENTS

The FORTRAN source files PRECIS.F77, IBMTST1.F77, and IBMTST4.F77 are provided on tape. The listings of these programs occur in Exhibit C-1.

5.14 DISTRIBUTED GIS SUPPORT FOR WORKSTATIONS & X-TERMINALS DATA REQUIREMENTS

The same data sets that are to be used for the re-engineered application will be used for this functional demonstration. Section 2.0 of this Appendix discusses the Legal Land Data. Section 3.0 of this Appendix discusses the Resource Data, which includes DLG, DEM, and PCCS Data files. Section 4.0 of this Appendix discusses the Data Dictionary for the Legal Land and Resource Data.

5.15 RESERVED

5.16 RASTER DEVICE SUPPORT AND VECTOR FEATURE EDITING DATA REQUIREMENTS

Map1, is a standard paper copy of the 1985 Turley, New Mexico USGS 7.5 minute topographic quadrangle map.

Photo1, is a color infrared, positive film transparency of the Southwest quarter of the Turley, New Mexico quadrangle, derived from the NAPP.

RDFile2 is a standard USGS digital line graph of the transportation features associated with the topographic quadrangle map provided above. The DLG file name is NAVAJO-RESERVOIR.AZ1.RDS.

RDFile3 is an ASCII ground control point file associated with the Turley, New Mexico quadrangle. The control point file format is as follows:

The control point file shall contain a list of latitude/longitude and UTM coordinate pairs for each point. Each record contains the following for each coordinate pair:

(Point Number) (Longitude) (Latitude) (Easting) (Northing)

The longitude/latitude fields contain three sets of numeric values each. These values are two to four characters wide describing in order the degrees, minutes, and seconds (to a tenth of a second). The three numeric values are followed by a single character describing the hemisphere of the numeric values (e.g., W is western hemisphere and N is the northern hemisphere). Each field is separated by a single space character. The longitude and latitude descriptions are separated by two space characters.

Following the longitude/latitude fields are three space characters, then the fields describing the corresponding UTM Easting and Northing. These two fields, separated by two space characters, are written as 10.2 (in FORTRAN F10.2) numeric field values. More specifically, 10 single integer digits, then a decimal point, followed by two more single integer digits.

RDFile4 is a standard USGS digital elevation model covering the same area as the topographic quadrangle map provided above. The DEM file name is AZTEC.SE.

The image transfer format, referred to in section 2.16.4, is as follows:

> An image transfer file contains only data arranged in a matrix form of rows and columns. The file has no header or trailer. Each column or cell in a single row contains a value representing an image or picture element (i.e., pixel). These values are stored as single 8-bit bytes; so, they range numerically from 0 - 255. A row of pixels are stored as a logical record of N pixels. The blocking factor is one. The rows are arranged in the file so the first row represents the top of the image and the last row represents the bottom of the image. The first column represents the left side of the image and the last column represents the right side of the image.
>
> The number of rows, M, determines the length of the image. An image may have multiple co-located cells (i.e., values at the same geographic locations) called bands, representing data derived from different parts of the magnetic spectrum or different colors (i.e., red, green, and blue). So an image may consist of M rows of N cells each for K co-located bands of image data.
>
> An image transfer format file with K bands will have each geographically co-located row arranged sequentially one after another. Thus the file arranged row one of band1, row one of band 2, ..., row two of band K, ..., row M of band 1, row M of band 2, ..., row M of band K.

If necessary, additional copies of Map1 can be ordered from Map Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225.

If necessary, additional copies of Photo1 can be ordered from the following address:

USDA-ASCS Aerial Photography Office
P.O. Box 30010 2222 West 2300 South
Salt Lake City, UT 84130-0010

Order Color Infrared (CIR) Cibs film positive (10 inch by 10 inch), NHAP Year NHAP2, Roll Number 363, Exposure Number 127.

5.17 RESERVED

5.18 GIS EDGE MATCHING

All input data files are in ADS format, please refer to Exhibit D-9 for the ADS data file formats. The file names required for this FD are as follows:

ADS.B743114	B743114.BORDER	B743114.MENUS	B743114.SOILS.L B743114.SOILS.L.F
ADS.C643114	C643114.BORDER	C643114.MENUS	C643114.SOILS.L C643114.SOILS.L.F
ADS.C743114	C743114.BORDER	C743114.MENUS	C743114.SOILS.L C743114.SOILS.L.F
ADS.C843114	C843114.BORDER	C843114.MENUS	C843114.SOILS.L C843114.SOILS.L.F
ADS.D743114	D743114.BORDER	D743114.MENUS	D743114.SOILS.L D743114.SOILS.L.F
ADS.DLG1	DLG1.BORDER	DLG1.MENUS DLG1.LANDLI.A	DLG1.LANDLI.L DLG1.LANDLI.L.F
ADS.DLG4	DLG4.BORDER	DLG4.MENUS	DLG4.LANDLI.L DLG4.LANDLI.A
ADS.DLG5	DLG5.BORDER	DLG5.MENUS DLG5.LANDLI.A	DLG5.LANDLI.L DLG5.LANDLI.L.F
ADS.DLG7	DLG7.BORDER DLG7.LANDLI.A	DLG7.MENUS DLG7.LANDLI.A.F	DLG7.LANDLI.L DLG7.LANDLI.L.F

ADS.KIMCOM	KIMCOM.BORDER KIMCOM.LANDLI.A.F	KIMCOM.MENUS KIMCOM.LANDLI.A	KIMCOM.LANDLI.L KIMCOM.LANDLI.L.F
ADS.LAJUNM	LAJUNM.BORDER LAJUNM.LANDLI.A.F	LAJUNM.MENUS LAJUNM.LANDLI.A LAJUNM.LANDLI.L.F	LAJUNM.LANDLI.L
ADS.SPRNGM	SPRNGM.BORDER SPRNGM.LANDLI.L.F	SPRNGM.MENUS SPRNGM.LANDLI.A	SPRNGM.LANDLI.L SPRNGM.LANDLI.A.F
ADS.TWOBTM	TWOBTM.BORDER TWOBTM.LANDLI.A TWOBTM.LANDLI.S.F	TWOBTM.MENUS TWOBTM.LANDLI.S	TWOBTM.LANDLI.L TWOBTM.LANDLI.A.F TWOBTM.LANDLI.L.F
ADS.AD34117	AD34117.BORDER	AD34117.MENUS	AD34117.TRANSP.L AD34117.TRANSP.L.F
ADS.EH33117	EH33117.BORDER	EH33117.MENUS	EH33117.TRANSP.L EH33117.TRANSP.L.F
ADS.MONTANA	MONTANA.BORDER	MONTANA.MENUS	MONTANA.LANDLI.L MONTANA.LANDLI.L.F
ADS.IDAHO	IDAHO.BORDER	IDAHO.MENUS	IDAHO.LANDLI.L IDAHO.LANDLI.L.F
LANDLINES	SOILS	TRANSPORTATION	

5.19 RESERVED

5.20 GIS OVERLAY

The files identified in the scripts are in MOSS file format. The same files are also provided in MOSS Export format. These files have the same names with the extent ".EX", added. See Exhibit D-8 for MOSS file formats. The MOSS Export files may be used instead of, or in addition to, the MOSS files, at the discretion of the Offeror.

TC05A
TC06B
TC07B
TC08B
TC09B
TC10B
TC11B
TC12B
TC13B
TC01A
TC02A
TC03B
TC04B
TC06A
TC07A
TC08A
TC09A
TC10A
TC11A
TC12A
TC13A
TC14A
TC01B
TC02B
TC04A
TC03A
TC05B

5.21 GIS OVERLAY VOLUME CAPACITY

The files identified in the script, COUNTY_USA, COUNTY_USA.AT and PHYSIO_USA, are in MOSS vector format, polygon structure. These same three files are also provided in MOSS Export format. They are called COUNTY.EX, COUNTY.DAT, and PHYSIO.EX respectively. COUNTY.DAT is a text file which contains the multiple attributes for COUNTY_USA.AT. See Exhibit D-8 for MOSS file formats. The MOSS Export files may be used instead of, or in addition to, the MOSS files, at the discretion of the Offeror.

5.22 GIS UPDATE

The public land survey data is in ADS format, described in Exhibit D-9. The ADS file names required for this FD are as follows:

CHACO.OWNERS.L
CHACO.OWNERS.A.F
OWNERSHIP
CHACO.OWNERS.L.F
CHACO.BORDER
CHACO.OWNERS.A
CHACO.MENUS
ADS.CHACO

The three map names, referenced in the script, are as follows:

- 1:24,000 scale USGS 7.5′ quad:
  Crow Mesa West, NM, 1985

- 1 USGS 15′ quad:
  Nageezi, NM, 1959

- 1 BLM Surface-Minerals edition 1:100,000 scale
  30′ X 60′ map:
  Chaco Canyon, NM, 1978

These maps can be ordered from Map Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225.

The BLM Digital Line Graphs (DLGs) required for this FD are as follows:

CHACO-CANYON-AZ3.RDS11
CHACO-CANYON-AZ3.HYS11

The following coordinate files are in MOSS Export format.

LATLON.DATA - Latitude/Longitude coordinates
UTM.DATA - UTM coordinates
STPF.DATA - State Plane coordinates in Feet

Please refer to Exhibit D-8 for the MOSS Export File format.

Exhibit D-10 contains the file names of the source code of the USGS projection package.

5.23 GIS FEATURE TO GRID INTERPOLATION & CONTOURING

The D_SD_FLAT.DAT data file has the following format:

Field Name	Starting Column	Ending Column	Field Type
X-Coordinate	2	9	REAL(F8.1)
Y-Coordinate	26	32	INTEGER
Elevation_Value	64	65	INTEGER

The coordinates are in Universal Transverse Mercator Zone 13 and the elevation values are in feet.

The file FAULT.EX consists of the coordinates for two fault lines in the same geographical area as the point-data file. The data is in MOSS Export format. Please refer to Exhibit D-8 for the MOSS Export data file format.

The line data file, CARCYN.EX, consists of topographic contour data with numeric attributes. Elevations are in meters. The data file is in MOSS EXPORT format. Please refer to Exhibit D-8 for the MOSS EXPORT file format.

The rastor data file, CARRACAS.CANYON, consists of topographic cell data. It is in USGS Digital Elevation Model (DEM 7.5) format and consists of 470 rows and 382 columns. Cell height is 30 meters and cell width is 30 meters. The coordinate system is Universal Transverse Mercator, Zone 13. Elevation values are in meters. Please refer to exhibit D-16 for the DEM file formats.

5.24 RESERVED

5.25 GIS RASTER TO VECTOR CONVERSION

Each RASTER1, RASTER2, RASTER3, RASTER4 logical file consists of three physical MOSS MAPS data files. The first file has a ".CD" ending and contains cell data information. The second file has a ".CV" ending and contains cell value information. The third file has a ".HD" ending and contains header information. The cell values in files RASTER1, RASTER2, RASTER3, and RASTER4 indicate which cell values correspond to point, line and polygon data. In file RASTER1 cell values 1 through 5 define points, values 6 and 7 define lines, and values 8 and 9 define polygons. In file RASTER2 cell values 1 through 5 define points, values 6 through 23 define lines, and values 24 through 27 define polygons. In file RASTER3 cell value 2 defines points, cell value 1 defines lines, and cell values 3 through 10 define polygons. In file RASTER4, cell values 4 and 5 define points, cell values 8 and 10 define lines, and cell values 1 through 3, 6 and 7, and 15 and 16 define polygons. The maps were created by (1) overlaying the line data on the polygon data and (2) overlaying the point data on the results of (1). Therefore, point and line data can cover polygon data and point data can cover line data. For example, a line feature can cut across a contiguous polygonal feature in the input files provided. Please refer to Exhibit D-8 for the MOSS MAPS data file formats.

The data contained in the MOSS MAPS data files is also provided in text files. The data contained in the ".HD" and ".CV" files is provided in text files with the extent ".DAT," e.g., RASTER1.DAT. The data contained in the ".CD" files is provided in text files with the extent ".EX," e.g., RASTER1.EX. These ".EX" files contain one text record for each cell. The first field contains the row number, the second field contains the column number and the third field contains the cell value. All three fields are integer values. These text files may be used instead of, or in addition to, the MOSS MAPS files at the discretion of the Offeror.

5.26 GIS BUFFER ZONE DEVELOPMENT

The TC15, TC16, TC17, TC18, B.TESTRL, MATT.S, MATT.S.AT, SCTWOLFRG, and SCTSAGEHL data files are in MOSS format. The above files are also provided in MOSS EXPORT format. These files have the same names with the extension ".EX" added. MATT.S.DAT is a text file which contains the multiple attributes for MATT.S.AT. The MOSS Export files may be used instead of, or in addition to, the MOSS files, at the discretion of the Offeror. Please refer to Exhibit D-8 for the MOSS data file formats.

The following data files are in ADS format.

ADS.AD34117
AD34117.BORDER
AD34117.MENUS
AD34117.TRANSP.L
ADS.EH33117
EH33117.BORDER
EH33117.MENUS
EH33117.TRANSP.L

Please refer to Exhibit D-9 for the ADS data file formats.

Exhibit D-10 contains the file names of the source code of the USGS projection package.

5.27 RESERVED

5.28 GIS PROXIMITY

The files identified in the scripts, MDRWOLFRG and SCTWOLFRG, are in MOSS file format. These same two files are also provided in MOSS Export format. They are called MDRWOLFRG.EX and SCTWOLFRG.EX respectively. The MOSS Export files may be used instead of, or in addition to, the MOSS files at the discretion of the Offeror. Please see exhibit D-8 for the MOSS file formats.

5.29 GIS METES AND BOUNDS DATA REQUIREMENTS

The input filenames, J22N6W.IN, J22N7W.IN, and J22N8W.IN are in Rectangular data file format. The file MBDESC is in Metes and Bounds data file format. Please refer to Exhibit D-7 for the input data file formats and sample input data files.

5.30 RESERVED

5.31 RESERVED

5.32 RESERVED

5.33 RESERVED

5.34 NID GENERATION

The unique name identifier established for each BLM customer will be generated from action data and name and address data provided for case recordation, status, and mining claims. The file names to be used are:

Action Data: NM.FOUR, CR.FOUR, and MC.FOUR
Name and Address: NM.FIVE, CR.FIVE, and MC.FIVE

The file formats for this data are found in Exhibit D-2.

5.35 GRAPHICS PERFORMANCE

The following bitmap shall be used in this demonstration. It is in the standard X Windows bitmap format.

```
#define wingdogs_width 32
#define wingdogs_height 32
static char wingdogs_bits[] = {
0x60, 0x00, 0x00, 0x00, 0xc0, 0x00, 0x00, 0x00, 0x80, 0x03, 0x00,
0x00, 0x20, 0x0f, 0x00, 0x00, 0x40, 0x3e, 0x00, 0x00, 0xc0, 0x7f,
0x00, 0x80, 0x84, 0xff, 0x00, 0xc0, 0x86, 0xff, 0x00, 0xc0, 0x07,
0xff, 0x21, 0xe0, 0x0f, 0xfe, 0x23, 0xf0, 0x0f, 0xfe, 0x23, 0xfc,
0x1d, 0xfe, 0x13, 0xfe, 0x39, 0xfc, 0x13, 0xff, 0x3f, 0xfc, 0x83,
0xff, 0x9f, 0xfc, 0xc1, 0xff, 0x0f, 0xfe, 0xe0, 0xff, 0xf3, 0xff,
0xff, 0xff, 0xf9, 0xff, 0xff, 0xff, 0xfc, 0xff, 0xff, 0x7f, 0xf6,
0xff, 0xff, 0x1f, 0xfb, 0xff, 0xff, 0x07, 0xf8, 0xfd, 0xff, 0x03,
0xbc, 0xf9, 0xff, 0x01, 0x3c, 0xf9, 0xff, 0x01, 0x3e, 0xf0, 0xf7,
0x00, 0x1f, 0xe0, 0x77, 0x00, 0x1f, 0x80, 0x77, 0x00, 0x8f, 0x00,
0x6f, 0x00, 0xc7, 0x00, 0x6e, 0x80, 0x07, 0x00, 0x7c, 0x80, 0x0d,
0x00, 0xf8, 0x80, 0x1f, 0x00, 0xf0, 0x01};
```

6.0 EXHIBITS

The exhibits associated with this appendix are found at the end of the document, after all appendices.

APPENDIX E: MANAGEMENT REVIEWS

1.0 MANAGEMENT REVIEW INTRODUCTION

1.1 PURPOSE

This document contains the requirements for Management Reviews.

1.2 OVERVIEW

Offerors will demonstrate the validity and quality of the business and management aspects of the their proposals by conducting Life Cycle Management Reviews during the Witnessed Demonstrations. The Management Reviews will cover the proposed functional responsibilities and business relationships of the Offeror in the delivery of the products and performance of the activities required by the RFP.

The Offeror will perform the following Management Reviews during the Witnessed Demonstrations:

- Prime Contractor Management Review
- Subcontractor Relationships Management Review
- Project Planning Management Review
- Installation Management Review
- Training Management Review
- Maintenance Management Review

2.0 PRIME CONTRACTOR MANAGEMENT REVIEW

Traditionally, a project of this scope receives bids from teams of organizations that propose to work together in the fulfillment of the requirements of the contract. The Offeror will present the capabilities of the Prime Contractor to manage the overall effort and to serve as the conduit between the Government and the associated subcontractors. All organizations in each team shall present their business plans in order to demonstrate their ability to perform the Contract successfully.

The Offeror will present the Technology Insertion Program proposed in response to Section H.19 of the RFP, the Quality Assurance Program proposed in response to Section C.13, and the Configuration Management Support System proposed in response to Section C.12.

3.0 SUBCONTRACTOR RELATIONSHIPS MANAGEMENT REVIEW

The Offeror will describe the relationship between the Prime Contractor and each Subcontractor, including discussion of the flow of requirements from the Government through the Prime Contractor to the subcontractors and a discussion of the control and quality assurance of Contract deliverables. The Offeror will demonstrate that the Prime Contractor shall have effective contractual and practical influence upon the subcontractors.

4.0 PROJECT PLANNING MANAGEMENT REVIEW

For any delivery of systems and re-engineering software, the contractor delivering the systems and software must produce a project plan. This plan includes a project schedule and configuration for the implementation of the systems and software (refer to RFP Section J.12.2.) The Offeror will describe the installation planning capabilities of the Offeror in general and as specifically applied to the Offeror Demonstrations.

5.0 INSTALLATION MANAGEMENT REVIEW

The Offeror will demonstrate the Offeror's experience in all aspects of hardware, software, and communications system delivery. The Offeror will demonstrate the capability to manage the installation of all systems components (hardware, software, firmware, cabling, etc.) from its inception through maintenance turnover by means of a controlled, automated procedure. The Offeror will present both the general installation methodology proposed and the specific configuration management plan during the Witnessed Demonstrations.

6.0 TRAINING MANAGEMENT REVIEW

The Offeror will present the proposed methodology for developing and implementing a curriculum, training instructors, and developing supporting user documentation. The Offeror will describe his experience and capabilities in the management, development, and performance of training of the type specified in Section C.10 of the RFP; and in the development of supporting user documentation as described in Section C.10.10 of the RFP.

7.0 MAINTENANCE MANAGEMENT REVIEW

The Offeror will describe the Offeror's experience in the maintenance of systems and software of the type proposed in accordance with Section C.9 of the RFP.

APPENDIX F: DBMS RTE TEST

1.0 INTRODUCTION

This test is designed to stress the database in several ways. These include accessing large tables, joins between tables, keyed and non-keyed access, nested queries, optimized and non-optimized queries, sorts, batch loads, and interactive inserts.

1.1 SEQUENCE OF EVENTS

The test will be performed in five phases. The same test sequence will be performed for each phase, the only difference will be the number of users utilizing the system under test. The phases are defined as follows:

Workload Distribution by Number of Users

Phase	Number Machine Class	Query of Users	Query Group 0	Query Group 1	Query Group 2	Query Group 3	Query Group 4	Query Group 5	Query Group 6
I	A	94	5	38	9	12	17	8	5
II	B	80	4	32	8	10	14	8	4
III	C	48	2	19	5	6	9	5	2
IV	D	24	1	10	2	3	5	2	1
V	E	16	1	6	2	2	3	1	1

The test sequence will be:

a. Generate flat files through custom utilities into the format required for each table.

b. Batch load the data into the tables from the flat files. Measure the time required to load each table.

c. Perform the various queries specified in section 3 of this appendix. Record the time of each query.

d. In addition, the following database manipulation functions will be executed:

   1. Multi-user inserts where each user references the same table and the records have unique key values. Record the time of each insert.

   2. Multi-user updates where each user references the same table and the records have unique key values. Record the time of each update.

   3. Multi-user deletes against the same table recording the time required for each delete.

e. Perform a backup at the 100% level. Note the total time required and the total number of tapes used.

2.0 DATABASE SCHEMA

2.1 TABLE DESCRIPTIONS

This database consists of 15 tables. The table descriptions are as follows:

casdat - This table contains the description of the customer's interests against a particular piece of BLM land.

cassta - This table contains the description of the status code found within the casdat table.

casact - This table contains the individual actions that are taking place to process the case filed by the customer.

spccor - This table contains the coordinates for the spatial data found in the spcdat table.

spcdat - This table contains the spacial data.

cstmst - This table contains the master list of customers.

cstxrf - This table contains the cross references between the customers and the case workers.

cswmst - This table contains the master list of case workers.

csqxrf - This table contains the cross reference between the case workers and their qualifications.

qlfmst - This table contains the descriptions of the qualification codes found within the cswmst table.

welmst - This table contains the description of well information, for example, oil or gas wells.

tnwxrf - This table contains the cross reference between the townships and the wells.

twpmst - This table contains the description of the townships.

rgtxrf - This table contains the cross reference between the regions and the townships.

regmst - This table contains the master list of regions.

castmp - Temporary table used for bulk inserts and bulk deletes of case data. Also need for case data unloading or exporting.

spctmp - Temporary table used for bulk inserts and bulk deletes of spacial data. This table is also used for data unloading or exporting.

2.2 **TABLE RELATIONSHIPS**

The table relationships are as follows:

```
                     qlfmst
                        |
          qlcd          |
                        |
                     csqxrf
                        |
          cwno          |
                        |
                     cswmst
                        |
          cwno          |
                        |
                     cstxrf
                        |
          cuno          |
                        |
                     cstmst
                        |
          cuno          |
                        |   stat
                      casdat---------- cassta
                        |
          csno          |
                        |
                        |
             tsno       |       wlno
     spcdat --------  casact ---------- welmst
      |  |              |                  |
tsno  |  |___ tsno      | tsno             | wlno
      |      |_______   |                  |
     spccor---------  twpmst ---------- tnwxrf
          tsno          |        tsno
                        |
                        |  tsno
                        |
                      rgtxrf
                        |
                        |  rgno
                        |
                      regmst
```

2.3 TABLE RECORD COUNTS AND SIZES

The record counts and size of each table are as follows:

Table Name	Number of Columns	Row Size	Number of Records	Size
casdat	33	2065	100,000	206.5 Megabytes
cassta	2	89	10	890 Bytes
casact	11	463	1,000,000	463 Megabytes
spccor	4	28	1,000,000	28 Megabytes
spcdat	2	1930	100,000	193 Megabytes
cstmst	20	1048	10,000	10.5 Megabytes
cstxrf	4	44	100,000	4.4 Megabytes
cswmst	14	276	1,000	.3 Megabytes
csqxrf	8	435	10,000	4.4 Megabytes
qlfmst	2	41	100	4.1 Kilobytes
welmst	4	53	1,000,000	53 Megabytes
tnwxrf	3	39	1,000,000	39 Megabytes
twpmst	5	53	100,000	5.3 Megabytes
rgtxrf	2	20	100,000	2 Megabytes
regmst	2	44	100	4.4 Kilobytes
spctmp	3	16	9,000	144 Kilobytes
castmp	7	86	2,700	232.2 Kilobytes

The storage requirement for the database is approximately 920 Megabytes from the tables listed above, plus 10% for index overhead. Therefore the total storage requirement is approximately 1.1 Gigabytes.

2.4 SCHEMA

The following are the database schemas:

```
---------------------------------------------------------------
REM
REM          BLM Customer Master Table
REM
create table cstmst
(
             cmcuno     char(12) not null,
             cmname     char(40),
             cmadd1     char(40),
             cmadd2     char(40),
             cmadd3     char(40),
             cmcity     char(24),
             cmstcd     char(4),
             cmzipc     char(8),
             cmsffx     char(4),
             cmphon     char(16),
             cmcmnt01        char(80),
             cmcmnt02        char(80),
             cmcmnt03        char(80),
             cmcmnt04        char(80),
             cmcmnt05        char(80),
             cmcmnt06        char(80),
             cmcmnt07        char(80),
             cmcmnt08        char(80),
             cmcmnt09        char(80),
             cmcmnt10        char(80)
)

grant all on cstmst to public;

create public synonym cstmst for cstmst;

---------------------------------------------------------------
REM
REM          BLM Customer Cross Reference to the Case Workers
REM
create table cstxrf
(
             cxcuno     char(12) not null,
             cxcwno     char(12) not null,
             cxefdt     number(8),
             cxexdt     number(8)
)

grant all on cstxrf to public;

create public synonym cstxrf for cstxrf;
---------------------------------------------------------------
```

```
-----------------------------------------------------------------
REM
REM          Case Worker Master Table
REM
create table cswmst
(            cwcwno     char(12) not null,
             cwname     char(40),
             cwadd1     char(40),
             cwadd2     char(40),
             cwadd3     char(40),
             cwcity     char(24),
             cwstcd     char(4),
             cwzipc     char(8),
             cwsffx     char(4),
             cwphon     char(16),
             cwssno     number(9),
             cwrgno     char(10),
             cwhrdt     number(8),
             cwqlcd     number(7)
)

grant all on cswmst to public;

create public synonym cswmst for cswmst;


-----------------------------------------------------------------
REM
REM          Case Worker Cross Reference to Qualifications
REM
create table csqxrf
(
             cqcwno     char(12) not null,
             cqqlcd     number(7) not null,
             cqdate     number(8),
             cqcmnt01        char(80),
             cqcmnt02        char(80),
             cqcmnt03        char(80),
             cqcmnt04        char(80),
             cqcmnt05        char(80)
)

grant all on csqxrf to public;

create public synonym csqxrf for csqxrf;

-----------------------------------------------------------------
```

```
-----------------------------------------------------------------
REM
REM          Qualification Master Table
REM
create table qlfmst
(
             qmqlcd      number(7) not null,
             qmdesc      char(32)
)

grant all on qlfmst to public;

create public synonym qlfmst for qlfmst;

-----------------------------------------------------------------
REM
REM          Well Master Table
REM
create table welmst
(
             wmwlno      number(8) not null,
             wmelev      number(8),
             wmlctn      char(1),
             wmdesc      char(32)
)

grant all on welmst to public;

create public synonym welmst for welmst;

-----------------------------------------------------------------
REM
REM          Township Cross Reference to Wells
REM
create table tnwxrf
(
             txtsno      number(8) not null,
             txwlno      number(8),
             txdesc      char(20)
)

grant all on tnwxrf to public;

create public synonym tnwxrf for tnwxrf;

-----------------------------------------------------------------
```

```
-----------------------------------------------------------------
REM
REM          Township Master Table
REM
create table twpmst
(
             tmtsno     number(8) not null,
             tmtwnp     char(10),
             tmmerd     char(5),
             tmrang     char(5),
             tmdesc     char(20)
)

grant all on twpmst to public;

create public synonym twpmst for twpmst;


-----------------------------------------------------------------
REM
REM          Region Cross Reference to Townships
REM
create table rgtxrf
(
             rxrgno     char(10) not null,
             rxtsno     number(8)
)

grant all on rgtxrf to public;

create public synonym rgtxrf for rgtxrf;

-----------------------------------------------------------------


-----------------------------------------------------------------
REM
REM          Region Master Table
REM
create table regmst
(
             rmrgno     char(10) not null,
             rmlctn     char(32)
)

grant all on regmst to public;

create public synonym regmst for regmst;


-----------------------------------------------------------------
```

```
----------------------------------------------------------------
REM
REM        Case Data Master Table
REM
create table casdat
(
           cdcsno     number(10) not null,
           cddesc     char(32),
           cdcuno     char(12),
           cdtsno     number(8),
           cdtscd     number(8),
           cdordt     number(8),
           cdrsdt     number(8),
           cdecst     number(9),
           cdacst     number(9),
           cdstat     number(7),
           cdcmnt01        char(80),
           cdcmnt02        char(80),
           cdcmnt03        char(80),
           cdcmnt04        char(80),
           cdcmnt05        char(80),
           cdcmnt06        char(80),
           cdcmnt07        char(80),
           cdcmnt08        char(80),
           cdcmnt09        char(80),
           cdcmnt10        char(80),
           cdcmnt11        char(80),
           cdcmnt12        char(80),
           cdcmnt13        char(80),
           cdcmnt14        char(80),
           cdcmnt15        char(80),
           cdcmnt16        char(80),
           cdcmnt17        char(80),
           cdcmnt18        char(80),
           cdcmnt19        char(80),
           cdcmnt20        char(80),
           cdcmnt21        char(80),
           cdcmnt22        char(80),
           cdcmnt23        char(80),
           cdcmnt24        char(80)
)

grant all on casdat to public;

create public synonym casdat for casdat;
----------------------------------------------------------------
```

```
-----------------------------------------------------------------
REM
REM          Case Status Number Master Table
REM
create table cassta
(
            csstat     number(7) not null,
            csstds     char(80)
)

grant all on cassta to public;

create public synonym cassta for cassta;


-----------------------------------------------------------------
REM
REM          Case Action Table
REM
create table casact
(
            cacano     number(10) not null,
            cacsno     number(10) not null,
            cawlno     number(8),
            catsno     number(8),
            catscd     number(8),
            cadate     number(8),
            cacmnt01        char(80),
            cacmnt02        char(80),
            cacmnt03        char(80),
            cacmnt04        char(80),
            cacmnt05        char(80)
)

grant all on casact to public;

create public synonym casact for casact;


-----------------------------------------------------------------
```

```
--------------------------------------------------------------------
REM
REM          Spacial Data Coordinates Table
REM
create table spccor
(
             sctsno     number(8) not null,
             scsqno     number(8),
             sccorx     number(4),
             sccory     number(4)
)

grant all on spccor to public;

create public synonym spccor for spccor;


--------------------------------------------------------------------
REM
REM          Spacial Data Table
REM
create table spcdat
(
             sdtsno     number(8) not null,
             sddata     long
)

grant all on spcdat to public;

create public synonym spcdat for spcdat;


--------------------------------------------------------------------
```

```
--------------------------------------------------------------------
REM
REM         Create a view to find detail information for a
            specific case
REM
create view caseinfo (
            v_cdcsno, v_cddesc, v_cacsno, v_tmtsno, v_tmdesc,
            v_rmrgno, v_rmlctn, v_wmwlno, v_wmlctn, v_csstat,
            v_csstds, v_cmcuno, v_cmname, v_cdordt, v_cwcwno)
as select
            cdcsno, cddesc, cacsno, tmtsno, tmdesc,
            rmrgno, rmlctn, wmwlno, wmlctn, csstat,
            csstds, cmcuno, cmname, cdordt, cwcwno
from
            casdat, casact, twpmst, rgtxrf, regmst,
            welmst, cassta, cstmst, cstxrf, cswmst
where
            cwcwno = cxcwno and
            cxefdt <= cdordt and
            cxexdt > cdordt and
            cxcuno = cdcuno and
            cmcuno = cdcuno and
            csstat = cdstat and
            wmwlno = cawlno and
            rmrgno = rxrgno and
            rxtsno = catsno and
            tmtsno = catsno and
            cacsno = cdcsno and
            cdcsno = 0001000001;

grant all on caseinfo to public;

create public synonym caseinfo for caseinfo;


--------------------------------------------------------------------
REM
REM         Temporary Spacial Data Coordinates Table
REM         Create temporary table used by bulk insert and bulk
            delete.
REM
create table spctmp
(
            sttsno     number(8) not null,
            stcorx     number(4),
            stcory     number(4)
)

grant all on spctmp to public;

create public synonym spctmp for spctmp;
--------------------------------------------------------------------
```

```
-----------------------------------------------------------------
REM
REM          Temporary Case Data Table
REM          Create temporary case table to export to an ASCII
             case file.
REM
create table castmp
(
             ctcsno     number(10) not null,
             ctdesc     char(32),
             ctcuno     char(12),
             cttsno     number(8),
             ctordt     number(8),
             ctrsdt     number(8),
             ctwlno     number(8)
)

grant all on castmp to public;

create public synonym castmp for castmp;


-----------------------------------------------------------------
```

3.0 DATABASE QUERIES

The queries are broken into the following seven groups:

0. Management Reports
1. A/N Queries
2. Data Entry
3. Spatial Queries (online)
4. Spatial Processing (file extract)
5. A/N Case Processing (file extract)
6. A/N and Spatial Update

The queries are in an ASCII file called QRYDESC. Within some of the following queries the selection criteria contains zzz or zzzz. These will be replaced with a unique value for each user.

0. MANAGEMENT REPORTS (5%)

Query 0.1 - Nested 5 table join and ranges.
Find customer/case worker status information for those cases which had activity on a given range of dates.

```
select
            cmcuno, cmname, cwcwno, cwname, cxefdt,
            cdcsno, cddesc, cdordt, cdstat, csstds
from
            casdat, cstxrf, cstmst, cswmst, cassta
where
            csstat = cdstat and
            cmcuno = cdcuno and
            cwcwno = cxcwno and
            cxefdt <= cdordt and
            cxexdt >= cdordt and
            cxcuno = cdcuno and
            cdcsno in
            (select cacsno from casact
                where cadate >= 19840101 and cadate <= 19840105);
```

Query 0.2 - Non-nested single table using a range.
Search for all cases with a status of 5.

```
select
            cdcsno, cddesc, cdstat, cdordt
from
            casdat
where
            cdstat > 4 and
            cdstat < 6;
```

```
-----------------------------------------------------------------------
Query 0.3 - Non-nested single table using direct search.
Search for all cases with a status of 5.

select
            cdcsno, cddesc, cdstat, cdordt
from
            casdat
where
            cdstat = 5;
```

```
-----------------------------------------------------------------------
Query 0.4 - Non-nested single table using direct search.
Search for all cases with a status of 5 or 9.

select
            cdcsno, cddesc, cdstat
from
            casdat
where
            cdstat = 5 or
            cdstat = 9;
```

```
-----------------------------------------------------------------------
Query 0.5 - Non-nested using the aggregate function 'avg'.
Average the anticipated cost of each case in the case data table.

select avg(cdecst) from casdat;
```

```
-----------------------------------------------------------------------
Query 0.6 - Non-nested using the aggregate function 'sum'.
Sum the anticipated cost of each case in the case data table.

select sum(cdecst) from casdat;
```

1. A/N QUERIES (40%)

Note: The zzzz's found in this section of queries indicate a unique value assigned for each user.

Query 1.1 - Non-nested 2 table join and text comparison.
Find records in the case data table where the specified string exists, then read the case action table with the township number from the case data record.

```
select
             tmtsno, cdcmnt04
from
             twpmst, casdat
where
             cdcmnt04 like '%Case Data Mstr zzzz000001Cmnt 04%' and
             tmtsno = cdtsno;
```

Query 1.2 - Non-nested 3 table join and ranges.
Find all customers, past and present, for a range of case workers.

```
select
             cmcuno, cmname, cwcwno, cwname, cxefdt
from
             cstmst, cswmst, cstxrf
where
             cmcuno = cxcuno and
             cxcwno = cwcwno and
             cwcwno >= 'zzzz00000001' and cwcwno <= 'zzzz00000005';
```

Query 1.3 - Non-nested using the aggregate function 'count'.
Count the nubmer of records in the case data table.

```
select count(*) from casdat;
```

Query 1.4 - Nested 3 table join.
Find all the townships for a given region.

```
select
             rmrgno, rmlctn, tmtsno, tmtwnp
from
             regmst, twpmst
where
             rmrgno = 'zzzz000000' and
             tmtsno in
                 (select rxtsno from rgtxrf where rxrgno =
'zzzz000000');
```

Query 1.5 - Non-nested 3 table join.
Find all the townships for a given region.

```
select
             tmtsno, tmtwnp, rmrgno, rmlctn
from
             regmst, twpmst, rgtxrf
where
             rmrgno = 'zzzz000000' and
             tmtsno = rxtsno and
             rxrgno = 'zzzz000000';
```

Query 1.6 - Non-nested 10 table join.
Find detail information for a specific case.

```
select
             cdcsno, cddesc, cacsno, tmtsno, tmdesc,
             rmrgno, rmlctn, wmwlno, wmlctn, csstat,
             csstds, cmcuno, cmname, cdordt, cwcwno
from
             casdat, casact, twpmst, rgtxrf, regmst,
             welmst, cassta, cstmst, cstxrf, cswmst
where
             cwcwno = cxcwno and
             cxefdt <= cdordt and
             cxexdt > cdordt and
             cxcuno = cdcuno and
             cmcuno = cdcuno and
             csstat = cdstat and
             wmwlno = cawlno and
             rmrgno = rxrgno and
             rxtsno = catsno and
             tmtsno = catsno and
             cacsno = cdcsno and
             cdcsno = zzzz000001;
```

```
-----------------------------------------------------------------------
Query 1.7 - Non-nested 5 table join without sort.
Find all open or pending cases for a specific case worker.

select
            cdcsno, cddesc, cdstat, csstds, cxcuno,
            cmname, cwcwno, cwname, cdordt, cdrsdt
from
            casdat, cstxrf, cstmst, cswmst, cassta
where
            cwcwno = cxcwno and
            cmcuno = cdcuno and
            cxefdt <= cdordt and
            cxexdt > cdordt and
            cdstat = 1 and
            cdcuno = cxcuno and
            cxcwno = 'zzzz00000000';


-----------------------------------------------------------------------
Query 1.8 - Non-nested 5 table join sort.
Find all open or pending cases for a specific case worker.

select
            cdcsno, cddesc, cdstat, csstds, cxcuno,
            cmname, cwcwno, cwname, cdordt, cdrsdt
from
            casdat, cstxrf, cstmst, cswmst, cassta
where
            cwcwno = cxcwno and
            cmcuno = cdcuno and
            cxefdt <= cdordt and
            cxexdt > cdordt and
            cdstat = 1 and
            cdcuno = cxcuno and
            cxcwno = 'zzzz00000000'
order by cdcsno;


-----------------------------------------------------------------------
Query 1.9 - Non-nested 3 table join.
Find all customers for a given case worker.

select
            cmcuno, cmname, cwcwno, cwname, cxefdt
from
            cstmst, cswmst, cstxrf
where
            cmcuno = cxcuno and
            cxcwno = cwcwno and
            cwcwno = 'zzzz00000001';
```

Query 1.10 - Non-nested 10 table join through a view.
Find detail information for a specific case.

```
select *
from
            caseinfo
where
            v_cdcsno = 001000001;
```

2. DATA ENTRY (10%)

Note: The zzzz's found in this section of queries indicates a unique value assigned for each user. The yyyyyy's are sequence numbers that increment with every loop of this seciton of scripts.

Query 2.1 - Insert one case into the case action table.

```
insert into casact(cacano, cacsno) values
            (zzzzyyyyyy,111);
```

Query 2.2 - Update one case in the case action table.

```
update casact
            set cawlno = 222
where
            cacano = zzzzyyyyyy and cacsno = 111;
```

Query 2.3 - Delete one case from the case action table.

```
delete from casact
where
            cacano = zzzzyyyyyy and
            cacsno = 111 and
            cawlno = 222;
```

3. SPATIAL QUERIES - ONLINE (13%)

Note: The zzzz's found in this section of queries indicates a unique value assigned for each user.

Query 3.1 - This query simulated a retrieval of a single map (total number of characters is 1920).

```
select
            sdtsno, sddata
from
            spcdat
where
            sdtsno = zzzz0001;
```

Query 3.2 - This query simulated ordering coordinates in preparation of a map display.

```
select
            sctsno, sccorx, sccory
from
            spccor
where
            sctsno = zzzz0001
order by
            sccorx, sccory
desc;
```

Query 3.3 - This query simulates a retrieval of two maps (total number of characters is 3840).

```
select
            sdtsno, sddata
from
            spcdat
where
            sdtsno = zzzz0001 or
            sdtsno = zzzz0999;
```

4. SPATIAL PROCESSING - FILE EXTRACT (18%)

Note: The zzz's and zzzz's found in this section of queries indicates a unique value assigned for each user.

Create a temporary table for each user performing this set of queries.

```
create table spctmpzzz
(
            sttsno     integer not null,
            stcorx     integer,
            stcory     integer
);
```

Query 4.1 - Bulk insert.
Find all townships within a given range and insert into temporary table. This will simulate extracting spatial coordinate data, to presumably send to another loaction.

```
insert into spctmp (sttsno, stcorx, stcory)
select
            sdtsno, sccorx, sccory
from
            spcdat, spccor
where
            sctsno = sdtsno and
            sdtsno >= zzzz0001 and
            sdtsno <= zzzz0005;
```

Query 4.2 - Batch unload/export.
Extract spacial data file to an ASCII text file, spatial.out.
(Note: Offerors can change the syntax of this query to the syntax of the proposed DBMS.)

```
unload to ./spatial.out delimiter "|"
select * from spctmp;
```

Query 4.3 - Bulk delete.
Delete all records from the temporary table associated with a range of townships.

```
delete from spctmp
where
            sttsno >= zzzz0001 and
            sttsno <= zzzz0005;
```

Drop temporary table created previously.

```
drop table spctmp;
```

5. A/N CASE PROCESSING - FILE EXTRACT (9%)

Note: The zzz's and zzzz's found in this section of queries indicates a unique value assigned for each user.

Create temporary table for each user performing this set of queries.

```
create table castmp
(
            ctcsno     integer not null,
            ctdesc     char(32),
            ctcuno     char(12),
            cttsno     integer,
            ctordt     integer,
            ctrsdt     integer,
            ctwlno     integer
);
```

Query 5.1 - Bulk insert.
Extract case data file information to a temporary table.

```
insert into castmp
select
            cdcsno, cddesc, cdcuno, cdtsno,
            cdordt, cdrsdt, cawlno
from
            casdat, casact
where
            cacsno = cdcsno and
            cdcsno > zzzz000000 and
            cdcsno < zzzz000031;
```

Query 5.2 - Batch unload/extract.
Unload/extract case data file to an ASCII file, case.out.
(Note: Offerors can change the syntax of this query to the syntax of the proposed DBMS.)

```
unload to ./case.out delimiter "|"
select * from castmp;
```

Query 5.3 - Bulk delete.
Delete case data from the temporary table for a range.

```
delete from castmp
where
            ctcsno < zzzz000031;
```

Drop temporary table created for this set of queries.

```
drop table castmp;
```

6. A/N AND SPATIAL UPDATE (5%)

Note: The zzzz's found in this section of queries indicates a unique value assigned for each user.

Query 6.1 - Bulk update.
Repair an offset problem with y coordinate in spatial data coordinate table.

```
update spccor
            set sccory = sccory + 2
where
            sctsno between zzzz0010 and zzzz0013;
```

Query 6.2 - Change township code in case action table to match township code in case data table due to data entry error.

```
update casact
            set catscd = (select cdtscd
                      from casdat
                      where cdcsno = zzzz000000)
where
            cacsno >= 000000 and
            cacsno <= 000039 and
            catscd != (select cdtscd
                   from casdat
                   where cdcsno = zzzz000000);
```

Query 6.3 - Change township code in case action table to match township code in case data table due to a data entry error.

```
update casact
            set catscd = 00000000
where
            cacsno >= zzzz000000 and
            cacsno <= zzzz000039;
```

EXHIBIT 1: RESERVED

EXHIBIT 2: BUSINESS BENCHMARK PERFORMANCE REQUIREMENTS

Host Machine A

Test results are "Average Seconds Required to Complete Test" at the 100 "Number of Copies Running" point, taken from the Business Benchmark Report.

Total size of disk cache buffers shall not exceed 6.0 megabytes.

Test Number	Maximum Acceptable Seconds	Test Results for Proposed System
1	22	
3	50	
7	13	
11	53	
12	53	
13	30	
14	47	
18	90	

Submit complete Business Benchmark report with proposal as backup for these test results.

Host Machine B

Test results are "Average Seconds Required to Complete Test" at the 80 "Number of Copies Running" point, taken from the Business Benchmark Report.

Total size of disk cache buffers shall not exceed 6.0 megabytes.

Test Number	Maximum Acceptable Seconds	Test Results for Proposed System
1	20	
3	46	
7	10	
11	43	
12	40	
13	20	
14	40	
18	94	

Submit complete Business Benchmark report with proposal as backup for these test results.

Host Machine C

Test results are "Average Seconds Required to Complete Test" at the 60 "Number of Copies Running" point, taken from the Business Benchmark Report.

Total size of disk cache buffers shall not exceed 6.0 megabytes.

Test Number	Maximum Acceptable Seconds	Test Results for Proposed System
1	26	
3	60	
7	15	
11	56	
12	56	
13	26	
14	56	
18	97	

Submit complete Business Benchmark report with proposal as backup for these test results.

Host Machine D

Test results are "Average Seconds Required to Complete Test" at the 40 "Number of Copies Running" point, taken from the Business Benchmark Report.

Total size of disk cache buffers shall not exceed 3.0 megabytes.

Test Number	Maximum Acceptable Seconds	Test Results for Proposed System
1	35	
3	80	
7	20	
11	75	
12	75	
13	35	
14	75	
18	130	

Submit complete Business Benchmark report with proposal as backup for these test results.

Host Machine E

Test results are "Average Seconds Required to Complete Test" at the 20 "Number of Copies Running" point, taken from the Business Benchmark Report.

Total size of disk cache buffers shall not exceed 3.0 megabytes.

Test Number	Maximum Acceptable Seconds	Test Results for Proposed System
1	33	
3	66	
7	17	
11	62	
12	64	
13	31	
14	69	
18	108	

Submit complete Business Benchmark report with proposal as backup for these test results.

Advanced Workstation

Test results are "Average Seconds Required to Complete Test" at the 20 "Number of Copies Running" point, taken from the Business Benchmark Report.

Total size of disk cache buffers shall not exceed 3.0 megabytes.

Test Number	Maximum Acceptable Seconds	Test Results for Proposed System
1	24	
3	44	
6	30	
7	4	
10	16	
11	25	
12	30	
13	27	
14	30	
18	125	

Submit complete Business Benchmark report with proposal as backup for these test results.

Basic Workstation

Test results are "Average Seconds Required to Complete Test" at the 20 "Number of Copies Running" point, taken from the Business Benchmark Report.

Total size of disk cache buffers shall not exceed 3.0 megabytes.

Test Number	Maximum Acceptable Seconds	Test Results for Proposed System
1	36	
3	62	
6	35	
7	5	
10	25	
11	30	
12	35	
13	28	
14	45	
18	160	

Submit complete Business Benchmark report with proposal as backup for these test results.

Personal Workstation

Test results are "Average Seconds Required to Complete Test" at the 20 "Number of Copies Running" point, taken from the Business Benchmark Report.

Total size of disk cache buffers shall not exceed 3.0 megabytes.

Test Number	Maximum Acceptable Seconds	Test Results for Proposed System
1	48	
3	80	
6	40	
7	6	
10	36	
11	36	
12	48	
13	35	
14	60	
18	200	

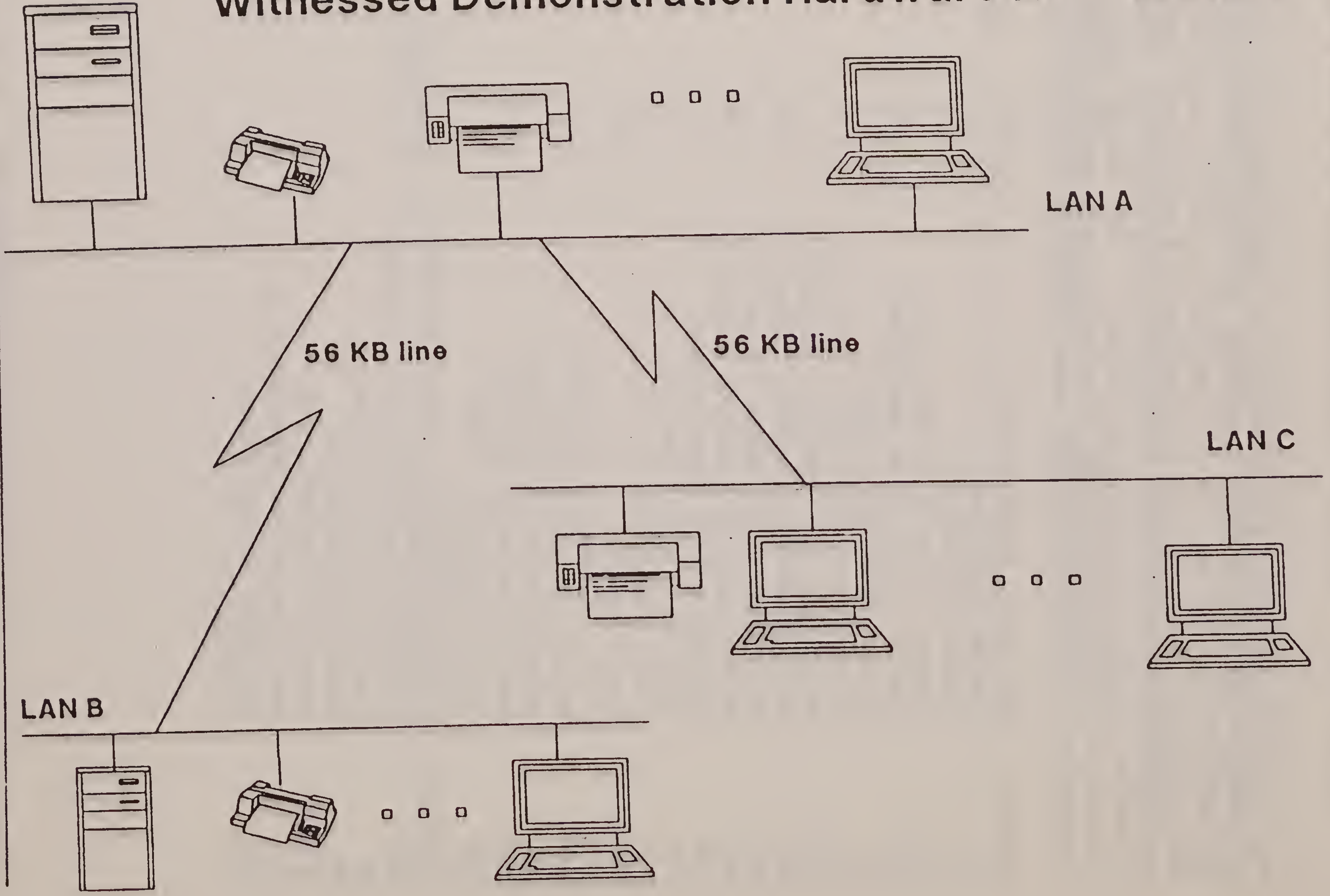
Submit complete Business Benchmark report with proposal as backup for these test results.

EXHIBIT 3: WITNESSED DEMONSTRATION HARDWARE ARCHITECTURE

The table below lists the hardware components required for the Witnessed Demonstrations required in response to RFP #YA-652-RFP9-440008. Each component has an abbreviation and a description, followed by the number of units of that type of hardware which are to be present on each of the three Local Area Networks (LANs) of a type proposed. The three LANs are to be connected to each other by simulated dedicated 56 Kbps links connected to the LAN to WAN communication interface.

Abbrev	Hardware Description	LAN A	LAN B	LAN C
DL	Large Digitizer			1
DS	Small Digitizer			1
FRL	Large Color Film Recorder		1	
FRS	Small Color Film Recorder			1
HC	Color Hard Copy Unit			1
MPA	Multi-user Processor Class A	1		
MPB	Multi-user Processor Class B	1		
MPC	Multi-user Processor Class C	1		
MPD	Multi-user Processor Class D		1	
MPE	Multi-user Processor Class E	1		
PBR	Portable Bar Code Reader			
PLE	Electrostatic Plotter		1	1
PLF	Flat Bed Plotter			1
PLP	Pen Plotter	1		1
PPM	Page Printer Mid-Range	1		
PMF	Multi-Form Printer		1	
PPL	Page Printer Low-Range			
PSN	Serial Printer Narrow	1		
PSW	Serial Printer Wide		1	1
SC	Color Scanner			1
SD	Document Scanner	1		
SPC	Photogrammetric Color Scanner			1
WA	Advanced Workstation	1		1
WB	Basic Workstation	1	1	1
WP	Personal Workstation	1	1	
WD	Administrative Workstation	1		
WPT	Portable Workstation		1	
XT	X Terminal	1	1	

Witnessed Demonstration Hardware Architecture



1. Introduction

1.1 Organization and Contents of Handbook

What this AIRS Handbook is

This Handbook is designed to help both the novice and expert use the Automated Inspection Records System, or AIRS. The Handbook's format is designed to serve a variety of needs and readers.

Playscript Format

A variation of the playscript format known as structured writing is used throughout most of this document. The page you are reading now is in this format. Notice that the left-hand column contains a brief description of the material in the right-hand column. This allows the novice reader to first scan a chapter to get an idea of its overall content and organization; the novice can then read through all of the detailed material in the right-hand column to receive step-by-step instructions.

The expert user can also take advantage of the playscript format. The brief descriptive headings in the left-hand column can be scanned by the expert who is looking for information on a specific topic of interest; this saves the time and trouble it would take to scan paragraph after paragraph of detailed narrative.

Both novice and expert can use the large amounts of "white space" on each page to jot down notes and observations. This white space also makes the text easier to read by breaking it down into bite-sized chunks.

Task-Oriented Approach

This Handbook uses what is known as a task-oriented approach. This approach realizes that you as a user do not want to know how to build a watch--you just want to know how to tell the time. In other words, you probably do not particularly care about how a software system is designed or organized; you have a specific task in front of you and you want to know how to get it done as quickly and easily as possible.

As an example of how this approach works, consider the illustration of screens. A conventional approach will show all of the data entry and display screens bunched together in a separate chapter or appendix. This Handbook, on the other hand, illustrates screens over and over again as part of the description of each separate task. You do not have to keep flipping pages back and forth between illustrations and text. Everything you need for each task is generally right there in front of you.

This results in a lot of repetition and uses some extra paper. However, it also results in a guide that is much easier to understand and use.

1.2 AIRS System Overview

AIRS Primary Functions

AIRS is designed to provide automated support for the I&E program. Its primary function is to increase inspectors' field time by reducing the time spent collating inspection criteria information. In addition, it makes data and information available to management so that they can better manage the I&E program.

AIRS History

AIRS was developed in 1986 by the Service Center under the auspices of the Washington Office. It replaced the automated I&E program known as MS-1 (Mineral System 1) that ran on the U.S. Geological Survey MULTICS computer.

Since its inception, the AIRS system has undergone numerous revisions. The latest version, 4.00, was released in early FY 91 under the auspices of the Washington Office Branch of Fluid Minerals Information (WO-613).

Menu-Driven Feature

AIRS is a menu-driven system, which makes it easy to use. 'Menu-driven' means that you do not have to memorize a long list of commands to operate the software. Instead, the screen displays a series of menus, which are lists of choices for you to make. You simply look over the list of options and type the number of the option you want. The AIRS system then automatically provides you with the proper data display, a data entry screen, or a submenu that provides you with further choices.

AIRS Capabilities

The AIRS system can record the following types of information:

1. Well and facility data required for a production inspection.
2. Ongoing inspections, including drilling, abandonment, and production inspections.
3. Results of previous inspections.
4. Incidents of noncompliance, assessments, and penalties.
5. Types of approvals, approval dates, and remarks.
6. Operator names and addresses.
7. Inspection priorities for each inspection item.
8. Estimates of average monthly production volumes.

AIRS can also track Applications for Permit to Drill (APDs) and sundry notices, as well as site restoration, meter proving, tank gauging, and well test inspections.

3.3 Entering a New Report

3.3.0 Overview

Overview

This section describes how to enter a New Inspection Report for either a "New" or an "Existing" Inspection Item (IID).

Entering a new report involves a number of different steps and menu options. Depending on the situation, you will have to either update or create various AIRS records. An IID is "new" if it is the first time that an Inspection Report is to be entered for the IID or if the Inspection Report is the first report to be entered for the IID in any fiscal year. (i.e., priority year). Otherwise, the IID is in the "existing" category, which allows you to skip certain preliminary steps.

It is assumed in this section that the records (Header, Priority, Facility, Well, and Approval) exist for both "new" and "existing" IIDs. You will be asked to update these records based on annotations made by the inspector on the Inspection report, using the update features of AIRS. If a record does not exist, refer to Section 3.2 for detailed instructions on how to enter the missing record or records.

In this section we will also be using the add feature to enter the Inspection Report information; detailed instructions will be provided. Instructions for using the [TAB] key to move between data fields have been omitted from the tutorial; be sure you know this procedure. It is assumed that you have a good working knowledge of the Oil and Gas program, including the definitions and correct use of data fields. If you are not well versed in the I&E program, be sure to seek help before attempting to enter, modify, or delete data.

In the overview for Section 3.2, Entering a New IID, you noted that an Operator must inform the Authorized Officer (AO) of activities on the IID by using various forms. Information about the IID is also collected by BLM staff and recorded using BLM forms, including the Inspection Report (Form 3160-11). Much of the information that must be entered into AIRS has to be obtained from these forms, so you need to be familiar with them.

Where to Start

If your IID is new, please start with **Section 3.3.1.** If your IID is **existing**, skip ahead to **Section 3.3.2.**

NOTE: The Priority Information Record is summarized on the Inspection Report printout and is labeled "Inspection Priority(s) for (IID). Check the Inspection Report for any annotations. If the priority record does require updating, refer to Section 3.3.1 for details.

3.3 Entering a New Report

3.3.1 Updating the Priority Record

Updating a Priority Information Record (Introduction)

The Priority Information Record is a collection of data elements that are associated with setting of the priority of an Inspection Item to be inspected. The Washington Office sets the overall policy for determining the priority for Inspection Items in the I&E Strategy Instruction Memorandum issued each fiscal year. You should be familiar with this WO policy before entering, updating, or deleting Priority Information Records on AIRS.

NOTE: **A priority information record must be input into AIRS before any Inspection record can be entered.** It is policy that a priority record must exist for each fiscal year (priority year) that an IID is still active. An IID is considered active if (1) the IID has at any time had drilling activity and still is in the primary or extended term of the lease, or (2) the IID was abandoned with unplugged wells and/or with equipment on the leasehold. **All active IIDs should have a Priority Record for each priority year even if no Inspections are planned on a particular IID for that fiscal year.**

Inactive IIDs do not require a current priority record. An inactive IID is a lease that has expired where all wells have been plugged and abandoned. Inactive IIDs are on AIRS for historical purposes.

Priority information will probably be provided to you by the Inspector or other staff. Because AIRS will allow a priority record to be opened with only a priority year and no other data, it must be checked and updated to ensure that it is both accurate and complete prior to entry of a new inspection report. The accuracy of reports will be adversely affected if the priority record is not correctly maintained.

Once the overall priority has been set for an Inspection Item for the Priority Year, it should not be changed. The only exceptions are if an error was made during the data entry or in the initial determination, or if the priority for inspection has increased. The reason for not changing the priority is to allow AIRS to maintain an accounting record of the number and overall priority of all inspection items.

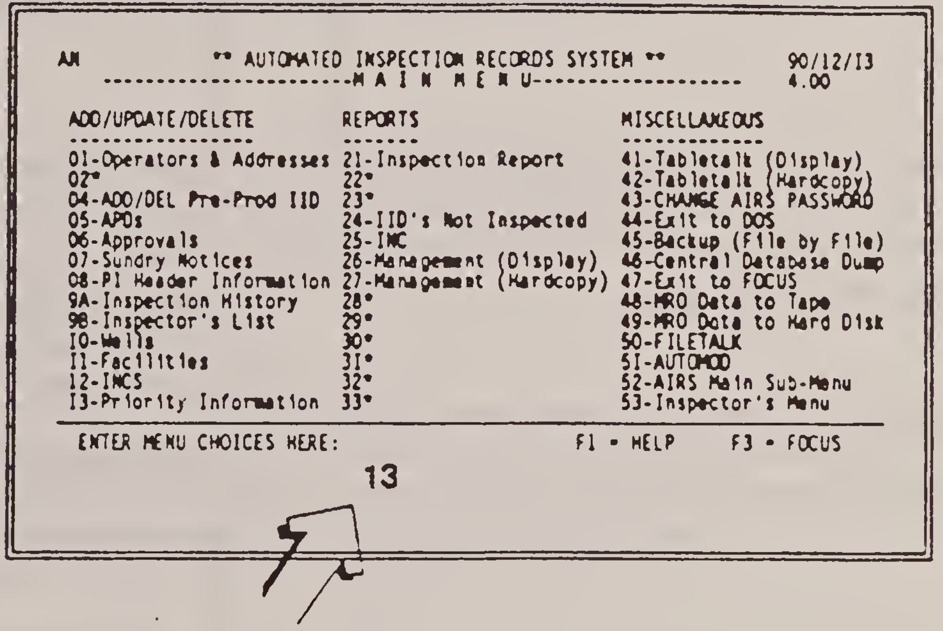
3.3 Entering a New Report

3.3.1 Updating the Priority Record

For example, let's say that an IID originally had a "W" (High FOGRMA) for an overall priority and, after an inspection (or other reason that the AO might want to change the priority), it was determined that the IID would no longer be a "W" but a "Z" (Low) priority. In this situation, any query of the number of priority "W's" completed would not count this IID as having been inspected during the priority year as a high priority. Since Congress has ordered us to inspect all FOGRMA high priority IIDs, it is important to accurately track our accomplishments. In this example, the correct procedure would be to ensure the change of overall priority is reflected in the next priority year.

Updating a Priority Information Record

From the Main Menu:

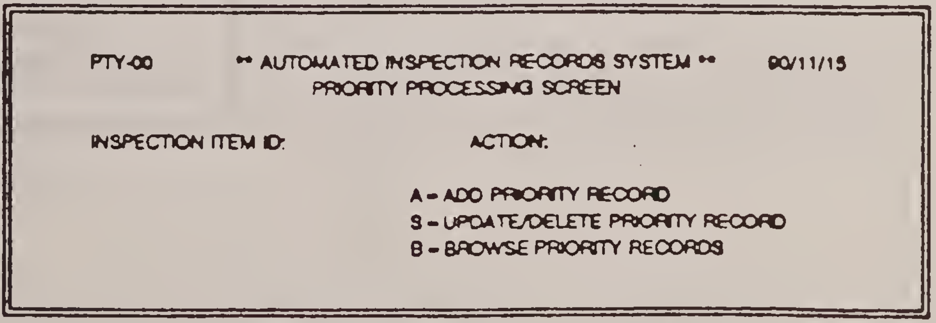


```
AM             ** AUTOMATED INSPECTION RECORDS SYSTEM **              90/12/13
       ------------------------M A I N  M E N U-------------------    4.00

 ADD/UPDATE/DELETE          REPORTS                      MISCELLANEOUS
 -----------------          -------                      -------------
 01-Operators & Addresses   21-Inspection Report         41-Tabletalk (Display)
 02*                        22*                          42-Tabletalk (Hardcopy)
 04-ADD/DEL Pre-Prod IID    23*                          43-CHANGE AIRS PASSWORD
 05-APDs                    24-IID's Not Inspected       44-Exit to DOS
 06-Approvals               25-INC                       45-Backup (File by File)
 07-Sundry Notices          26-Management (Display)      46-Central Database Dump
 08-PI Header Information   27-Management (Hardcopy)     47-Exit to FOCUS
 9A-Inspection History      28*                          48-MRO Data to Tape
 9B-Inspector's List        29*                          49-MRO Data to Hard Disk
 10-Wells                   30*                          50-FILETALK
 11-Facilities              31*                          51-AUTOMOD
 12-INCS                    32*                          52-AIRS Main Sub-Menu
 13-Priority Information    33*                          53-Inspector's Menu
 ------------------------------------------------------------------------------
  ENTER MENU CHOICES HERE:                         F1 = HELP     F3 = FOCUS
                           13
```

Type **13** in the area *ENTER MENU CHOICES HERE:* at the bottom of the Main Menu screen.

Press the **[ENTER]** key.

The PTY-00 screen is displayed:



```
PTY-00      ** AUTOMATED INSPECTION RECORDS SYSTEM **      90/11/15
                  PRIORITY PROCESSING SCREEN

INSPECTION ITEM ID:                  ACTION:

                                A = ADD PRIORITY RECORD
                                S = UPDATE/DELETE PRIORITY RECORD
                                B = BROWSE PRIORITY RECORDS
```

3.3 Entering a New Report

3.3.1 Updating the Priority Record

Entering an Inspection Item ID (IID) and Action Code

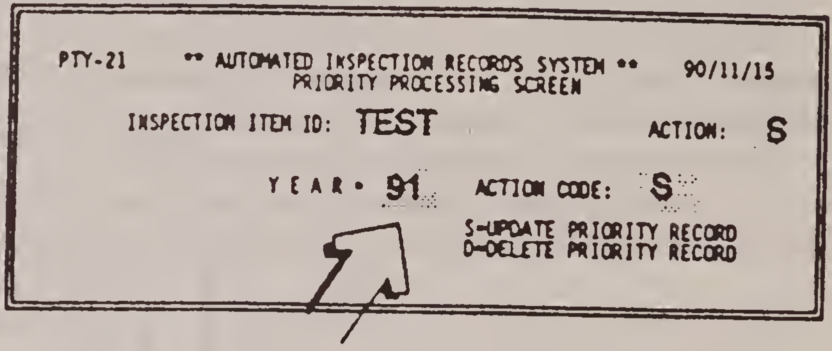
From the Priority Processing Screen you are asked to input (1) the Inspection Item ID for which you wish to check or update the Priority Record and (2) an Action code.

Type the Inspection Item ID you wish to update the priority records for in the *INSPECTION ITEM ID:* field.

Press the [TAB] key and type **S** in the *ACTION:* field.

Press the [ENTER] key.

The PTY-21 screen is now displayed:

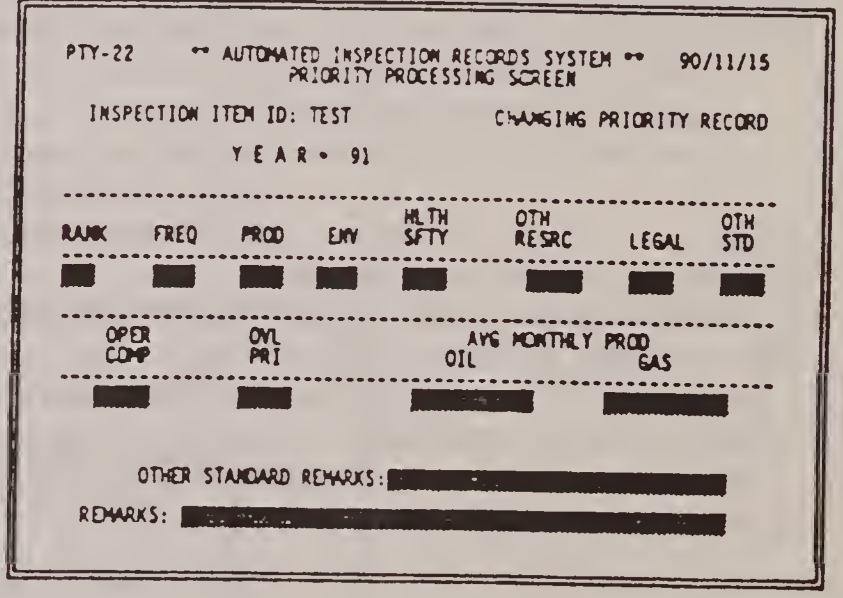


```
PTY-21     ** AUTOMATED INSPECTION RECORDS SYSTEM **     90/11/15
                 PRIORITY PROCESSING SCREEN
     INSPECTION ITEM ID: TEST                         ACTION:  S

                 Y E A R • 91     ACTION CODE:  S
                                  S-UPDATE PRIORITY RECORD
                                  D-DELETE PRIORITY RECORD
```

Entering the Priority Year

Type the last two digits of the Priority Year or fiscal year for which you wish to check or update priority information in the *YEAR* = field.

Press the [ENTER] key. The PTY-22 screen is displayed.



```
PTY-22     ** AUTOMATED INSPECTION RECORDS SYSTEM **     90/11/15
                 PRIORITY PROCESSING SCREEN
  INSPECTION ITEM ID: TEST              CHANGING PRIORITY RECORD
             Y E A R • 91
-----------------------------------------------------------------
                         HLTH    OTH               OTH
RANK  FREQ  PROD  ENV    SFTY    RESRC    LEGAL    STD
-----------------------------------------------------------------

-----------------------------------------------------------------
   OPER      OVL              AVG MONTHLY PROD
   COMP      PRI           OIL              GAS
-----------------------------------------------------------------


       OTHER STANDARD REMARKS:
  REMARKS:
```

3.3 Entering a New Report

3.3.1 Updating the Priority Record

NOTE: If you get the message 'Priority Year not on Data Base,' press the **F2** key and select the **A** action code to add a priority record. Follow the steps in Section 3.2.6, Entering a Priority Record, to add a priority record.

Checking the Priority Record

The priority record should be checked for blank data fields. Any blank data fields that are applicable to this IID should be completed. In all cases the *OVL PRI* (Overall Priority) field should be filled in. It is WO policy that the Average Monthly Production data fields for *OIL* and *GAS* shall be updated with each inspection or at least annually at the end of each fiscal year. The average monthly production is used in determining the priorities for the IID.

If you need additional information about the Priority Record, refer to Section 3.2.6, Entering a Priority Record.

Entering the Priority onto the Computer

Make any required updates to the appropriate data fields. When finished with any changes, press the **[ENTER]** key. The record will be updated in AIRS and the PTY-00 screen will be displayed.

Exiting the Priority Data Entry Screen

If you wish to escape without either saving your work or changing the existing information, press the **[F2]** key before pressing the **[ENTER]** key to return to the Priority Processing Screen (PTY-00) or press the **[F3]** key to return to the Main Menu.

Correcting Errors

Error messages will appear anytime an incorrect entry is made in an *edited* field. Edited fields will display entered data using green characters; the cursor will also be green.

Any error in an edited field must be corrected before the system will accept your data. The error messages appear in red at the bottom of the DES.

Errors made in unedited fields that are accepted by the computer may be corrected by using the UPDATE/DELETE PRIORITY RECORD (S) option of the PRIORITY PROCESSING (PTY-00) Screen.

3.3 Entering a New Report

3.3.1 Updating the Priority Record

Duplicating All Priority Records for a Given Priority Year

AIRS can duplicate the priority records for the current year to a future priority year. Details about this feature may be found in Section 7.3 of this Handbook.

3.3 Entering a New Report

3.3.2 Entering New Inspection Information

Entering the New Inspection Information (Introduction)

The main source of information for updating the AIRS system is the inspector's Inspection Report. The Inspection Report is a compilation of the results of the Inspector's field inspection(s), the header record, the well record, the priority record, the incidents of non-compliance (INC) record, the facility record, and the approval record for the IID. By annotating the Inspection Report printout in red, the inspector can flag data elements that require updating in the AIRS system.

The Inspection Report is a series of eight separate reports about the different record types in AIRS. The report begins with the header record (Main Menu 8), followed in order by the inspector's list (Main Menu 9B), a blank inspection history, the inspection history (Main Menu 9A), the well/completion record(s) (Main Menu 10), the facility records (Main Menu 11), the approval record (Main Menu 6), the priority record (Main Menu 13), and the INC records (Main Menu 12).

The Main Menu *ENTER MENU CHOICES HERE:* feature will allow you to queue up to five Main Menu choices. You can make use of this feature to speed up the data entry process.

Depending on the type of changes annotated by the Inspector, different AIRS records will need to be updated to enter the inspection data. For example: If you note that the header record, the inspector's list, the inspection history, and well record have been annotated by the inspector, you can then use the Main Menu to enter and queue all of these screens for updating by entering 8, 9B, 9A, and 10 in the *ENTER MENU CHOICES HERE:* fields. When you have completed a section and have pressed the **[ENTER]** key, the system will move to your next choice when you press the [F3] key.

3.3 Entering a New Report

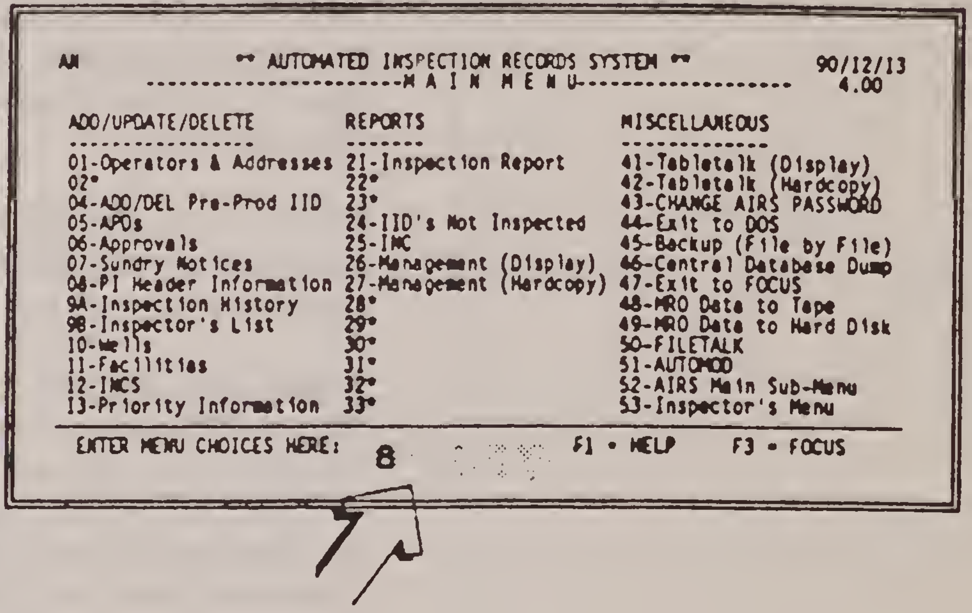
3.3.2 Entering New Inspection Information

Checking the Header Record Information

The Header Record Information is the first section of the Inspection Report. Check this section for any annotations made by the inspector. Also check for any blank fields and decide whether further research to obtain the missing data is warranted. If there are no annotations or missing data, move ahead to Section 3.3.3, Updating the Inspector's List. If there are annotations, you should enter the Header Record from the Main Menu and make the appropriate changes, as shown in this section.

Entering the Header Record

From the Main Menu:

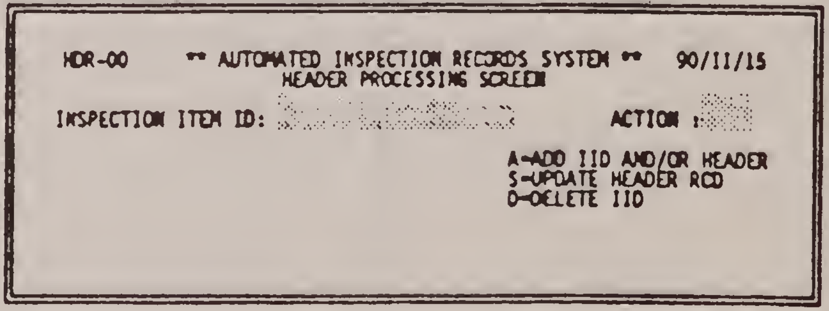


```
AN          ** AUTOMATED INSPECTION RECORDS SYSTEM **            90/12/13
     ----------------------M A I N  M E N U------------------     4.00

ADD/UPDATE/DELETE          REPORTS                     MISCELLANEOUS
-----------------          -------                     -------------
01-Operators & Addresses  21-Inspection Report        41-Tabletalk (Display)
02*                        22*                         42-Tabletalk (Hardcopy)
04-ADD/DEL Pre-Prod IID    23*                         43-CHANGE AIRS PASSWORD
05-APDs                    24-IID's Not Inspected      44-Exit to DOS
06-Approvals               25-INC                      45-Backup (File by File)
07-Sundry Notices          26-Management (Display)     46-Central Database Dump
08-PI Header Information   27-Management (Hardcopy)    47-Exit to FOCUS
9A-Inspection History      28*                         48-MRO Data to Tape
9B-Inspector's List        29*                         49-MRO Data to Hard Disk
10-Wells                   30*                         50-FILETALK
11-Facilities              31*                         51-AUTOMOD
12-INCS                    32*                         52-AIRS Main Sub-Menu
13-Priority Information    33*                         53-Inspector's Menu
--------------------------------------------------------------------------
ENTER MENU CHOICES HERE:    8                F1 = HELP      F3 = FOCUS
```

Type **8** in the area *ENTER MENU CHOICES HERE:* at the bottom of the Main Menu screen.

Press the [**ENTER**] key.

The HDR-00 screen is displayed:



```
HDR-00     ** AUTOMATED INSPECTION RECORDS SYSTEM **   90/11/15
                   HEADER PROCESSING SCREEN

INSPECTION ITEM ID:                             ACTION :

                                        A=ADD IID AND/OR HEADER
                                        S=UPDATE HEADER RCD
                                        D=DELETE IID
```

3.3 Entering a New Report

3.3.2 Entering New Inspection Information

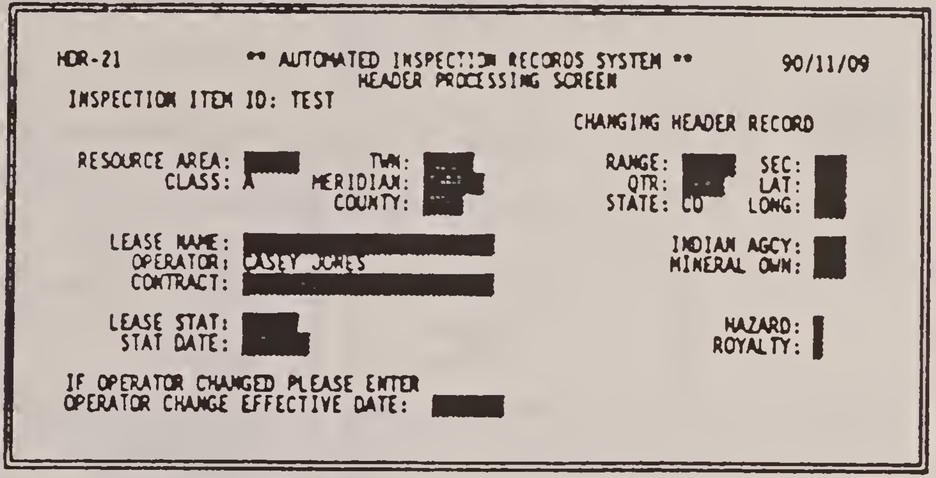
Entering the Inspection Item ID (IID) and Action Code

From the Header Processing Screen you are asked to input an Inspection Item ID and an Action code. The Inspection Item ID is found on the upper left of the Inspection Report.

Type the Inspection Item ID in the *INSPECTION ITEM ID:* field.

Press the [TAB] key and type **S** in the *ACTION:* field.

Press the **[ENTER]** key. The HDR-21 screen is displayed:



```
HDR-21          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/11/09
                          HEADER PROCESSING SCREEN
INSPECTION ITEM ID: TEST
                                                  CHANGING HEADER RECORD

 RESOURCE AREA:            TWN:                  RANGE:         SEC:
         CLASS: A     MERIDIAN:                    QTR:         LAT:
                        COUNTY:                  STATE: CO     LONG:

    LEASE NAME:                                        INDIAN AGCY:
      OPERATOR: CASEY JONES                            MINERAL OWN:
      CONTRACT:

    LEASE STAT:                                             HAZARD:
     STAT DATE:                                            ROYALTY:

IF OPERATOR CHANGED PLEASE ENTER
OPERATOR CHANGE EFFECTIVE DATE:
```

Entering Header Record Changes

Refer to the Inspector's Report and make the appropriate changes. Press the **[ENTER]** key to save your changes. If you need additional details about the header record, please refer to Section 3.2.2, Entering a Header Record.

Exiting the Header Data Entry Screen

If you wish to escape without saving your work or changing existing information, press the [F2] key to return to the Header Processing Screen (HDR-00). You can also press the **[F3]** key to return to the Main Menu or to your next choice on the Main Menu if you made use of the queue feature.

Correcting Errors

Error messages will appear anytime an incorrect entry is made in an *edited* field. Edited fields will display entered data using green characters; the cursor will also be green.

Any error in an edited field must be corrected before the system will accept your data. The error messages appear in red at the bottom of the DES.

Errors made in unedited fields that are accepted by the computer may be corrected by using the UPDATE HEADER RCD (S) option of the HEADER WELL (HDR-00) screen.

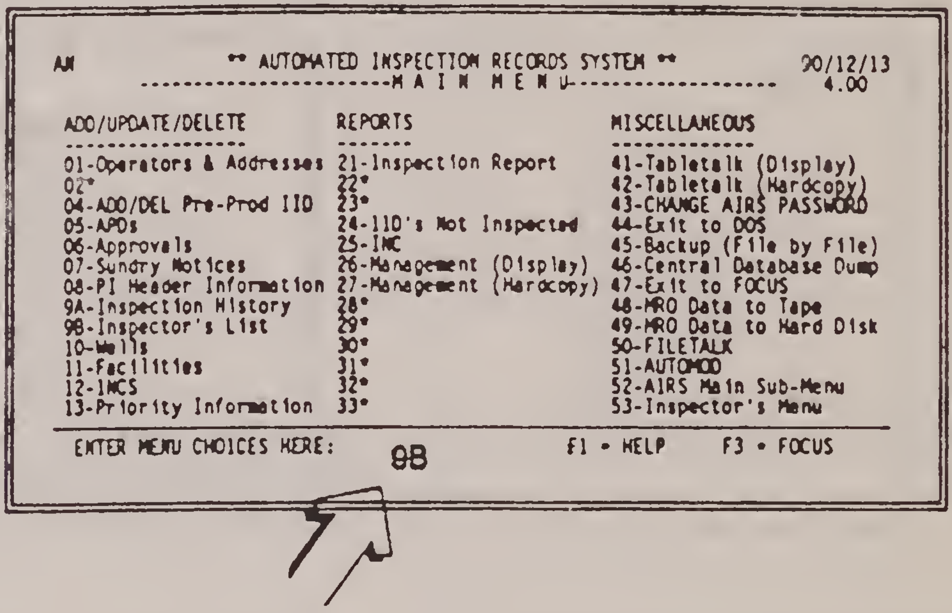
3.3 Entering a New Report

3.3.3 Updating the Inspector's List

Updating the Inspector's List (Introduction)

The Inspector's List is a listing of the various types of approvals that must be checked by the inspector on all IIDs. There is only one list per IID. The list contains a listing of approvals, the date when those approvals were inspected, and the results of the inspection (satisfactory, unsatisfactory, or not applicable). The list also contains information on hydrogen sulfide (a poison gas) operations and remarks.

From the Main Menu:

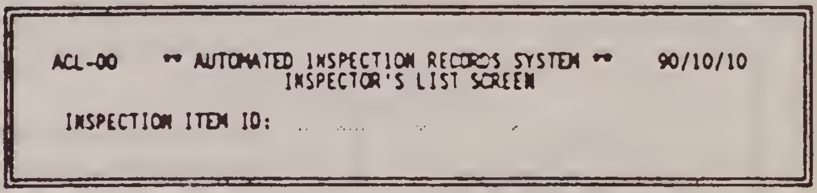


```
AM           ** AUTOMATED INSPECTION RECORDS SYSTEM **            90/12/13
        ----------------------M A I N  M E N U------------------    4.00

ADD/UPDATE/DELETE          REPORTS                     MISCELLANEOUS
-----------------          -------                     -------------
01-Operators & Addresses 21-Inspection Report          41-Tabletalk (Display)
02*                      22*                           42-Tabletalk (Hardcopy)
04-ADD/DEL Pre-Prod IID  23*                           43-CHANGE AIRS PASSWORD
05-APDs                  24-IID's Not Inspected        44-Exit to DOS
06-Approvals             25-INC                        45-Backup (File by File)
07-Sundry Notices        26-Management (Display)       46-Central Database Dump
08-PI Header Information 27-Management (Hardcopy)      47-Exit to FOCUS
9A-Inspection History    28*                           48-MRO Data to Tape
9B-Inspector's List      29*                           49-MRO Data to Hard Disk
10-Wells                 30*                           50-FILETALK
11-Facilities            31*                           51-AUTOMOD
12-INCS                  32*                           52-AIRS Main Sub-Menu
13-Priority Information  33*                           53-Inspector's Menu
---------------------------------------------------------------------------
 ENTER MENU CHOICES HERE:     9B               F1 = HELP      F3 = FOCUS
```

Type 9B in the area *ENTER MENU CHOICES HERE:* at the bottom of the Main Menu screen.

Press the [ENTER] key.

The following screen (ACL-00) is displayed:



```
ACL-00    ** AUTOMATED INSPECTION RECORDS SYSTEM **     90/10/10
                   INSPECTOR'S LIST SCREEN

 INSPECTION ITEM ID:
```

Entering an Inspection Item ID (IID)

From the Inspector's List Screen you are asked to input an Inspection Item ID. The Inspection Item ID is found on the upper left portion of the Inspection sheet.

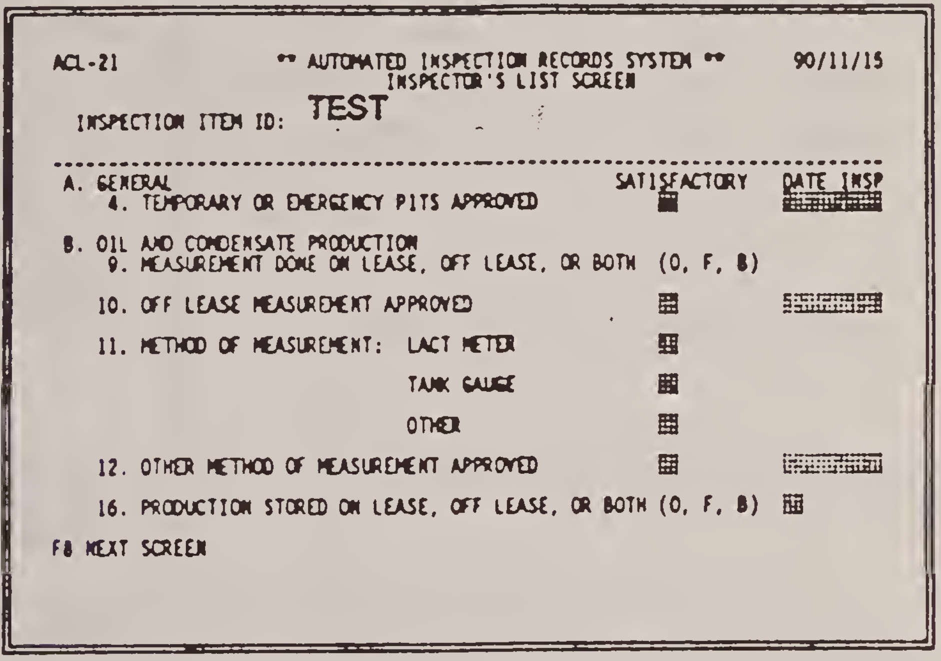
3.3.3 Updating the Inspector's List

Type the Inspection Item ID in the *INSPECTION ITEM ID:* field.

Press the [ENTER] key.

Updating the First Screen on the Inspector's List

The first of four screens (ACL-21) is displayed:



```
ACL-21          ** AUTOMATED INSPECTION RECORDS SYSTEM **        90/11/15
                        INSPECTOR'S LIST SCREEN
  INSPECTION ITEM ID: TEST
-------------------------------------------------------------------------
 A. GENERAL                                         SATISFACTORY  DATE INSP
     4. TEMPORARY OR EMERGENCY PITS APPROVED             ▦        ▦▦▦▦▦▦

 B. OIL AND CONDENSATE PRODUCTION
     9. MEASUREMENT DONE ON LEASE, OFF LEASE, OR BOTH  (O, F, B)

    10. OFF LEASE MEASUREMENT APPROVED                   ▦        ▦▦▦▦▦▦

    11. METHOD OF MEASUREMENT:  LACT METER               ▦

                                TANK GAUGE               ▦

                                OTHER                    ▦

    12. OTHER METHOD OF MEASUREMENT APPROVED             ▦        ▦▦▦▦▦▦

    16. PRODUCTION STORED ON LEASE, OFF LEASE, OR BOTH (O, F, B) ▦

F8 NEXT SCREEN
```

The Inspector's List is printed on the first page of the Inspection Report. Enter the appropriate changes that have been annotated by the inspector. The valid codes to be used in the SATISFACTORY column are:

Y = Satisfactory
A = Not Applicable
N = Not Satisfactory

F = Off Lease
O = On Lease
B = Both (On/Off Lease)

The DATE INSPECTED is the date, entered in YYMMDD format, that a particular approval was inspected last.

NOTE: You may have observed that there are many "skipped" numbers on the Inspector's List screens. Old checklist data has been eliminated except for the parts dealing with approvals in AIRS Version 4.00.

Approval items "A. General," to "B. Oil and Gas Condensate Production," item B. 16, are contained on the first (ACL-21) screen of four data entry screens.

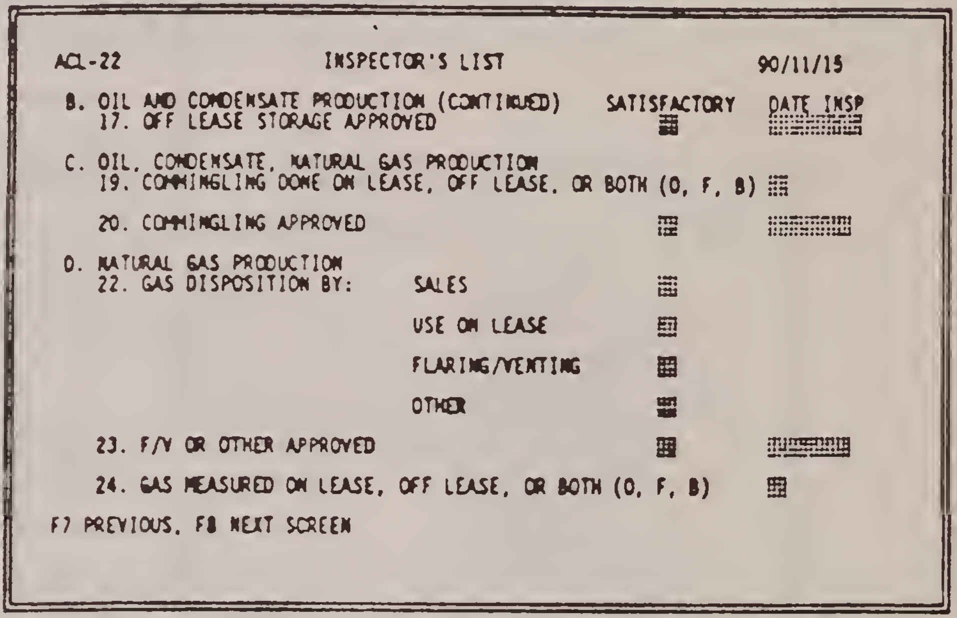
3.3 Entering a New Report

3.3.3 Updating the Inspector's List

When you have completed updating this portion of the inspector's list, press the **F8** key to move to the next screen.

Updating the Second Screen of the Inspector's List

The following screen is displayed:



```
ACL-22                     INSPECTOR'S LIST                        90/11/15
 B. OIL AND CONDENSATE PRODUCTION (CONTINUED)        SATISFACTORY   DATE INSP
    17. OFF LEASE STORAGE APPROVED

 C. OIL, CONDENSATE, NATURAL GAS PRODUCTION
    19. COMMINGLING DONE ON LEASE, OFF LEASE, OR BOTH (O, F, B)

    20. COMMINGLING APPROVED

 D. NATURAL GAS PRODUCTION
    22. GAS DISPOSITION BY:        SALES

                                   USE ON LEASE

                                   FLARING/VENTING

                                   OTHER

    23. F/V OR OTHER APPROVED

    24. GAS MEASURED ON LEASE, OFF LEASE, OR BOTH (O, F, B)
F7 PREVIOUS, F8 NEXT SCREEN
```

Continue to enter the appropriate changes as annotated on the Inspection Report.

Approval Items "B. Oil and Gas Condensate Production," item 17, to "D. Natural Gas Production," item D. 24, are contained on the second (ACL-22) screen.

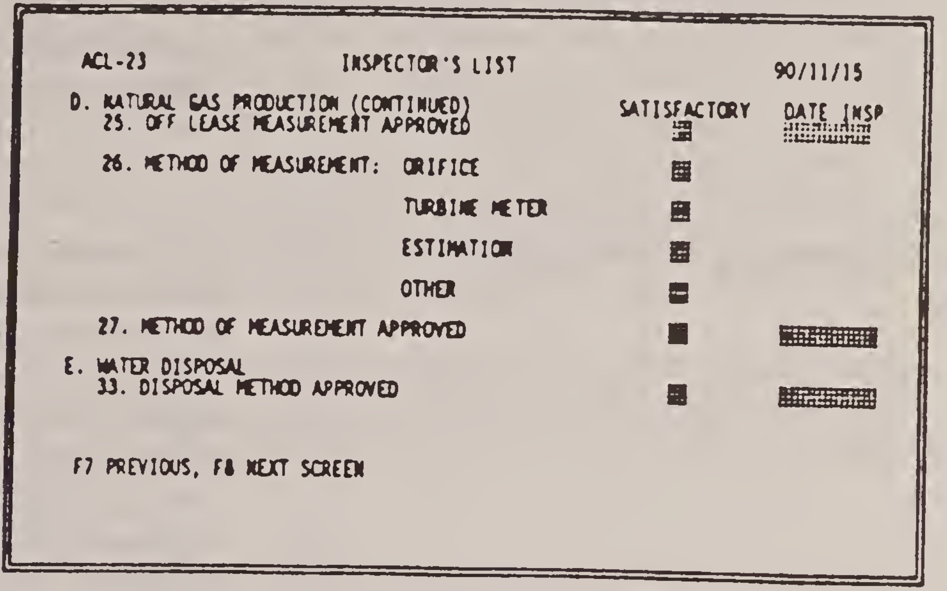
When you have completed updating this portion of the inspector's list, press the **F8** key to move to the next screen.

3.3 Entering a New Report

3.3.3 Updating the Inspector's List

Updating the Third Screen of the Inspector's List

The following screen is displayed:



```
ACL-23                    INSPECTOR'S LIST                              90/11/15
D. NATURAL GAS PRODUCTION (CONTINUED)                    SATISFACTORY  DATE INSP
   25. OFF LEASE MEASUREMENT APPROVED                         ▨         ▨▨▨▨▨▨
   26. METHOD OF MEASUREMENT:  ORIFICE                        ▨
                               TURBINE METER                  ▨
                               ESTIMATION                     ▨
                               OTHER                          ▨
   27. METHOD OF MEASUREMENT APPROVED                         ▨         ▨▨▨▨▨▨
E. WATER DISPOSAL
   33. DISPOSAL METHOD APPROVED                                ▨         ▨▨▨▨▨▨

F7 PREVIOUS, F8 NEXT SCREEN
```

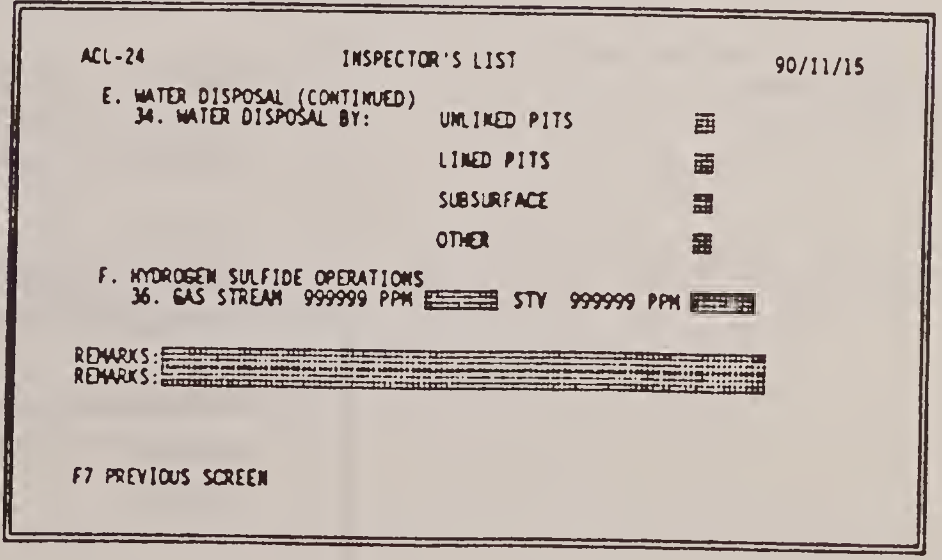
Continue to enter the appropriate changes as annotated on the Inspection Report.

Approval Items "D. Natural Gas Production," item D. 25 to "E. Water Disposal," item 33, are contained on the third (ACL-23) screen.

When you have completed updating this portion of the inspector's list, press the **F8** key to move to the fourth and final screen.

Updating the Final Screen on the Inspector's List

The following screen is displayed:



```
ACL-24                    INSPECTOR'S LIST                              90/11/15
  E. WATER DISPOSAL (CONTINUED)
     34. WATER DISPOSAL BY:      UNLINED PITS                 ▨
                                 LINED PITS                   ▨
                                 SUBSURFACE                   ▨
                                 OTHER                        ▨
  F. HYDROGEN SULFIDE OPERATIONS
     36. GAS STREAM  999999 PPM ▨▨▨▨ STV  999999 PPM ▨▨▨
REMARKS:▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨
REMARKS:▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨


F7 PREVIOUS SCREEN
```

3.3 Entering a New Report

3.3.3 Updating the Inspector's List

Continue to enter the appropriate changes as annotated on the Inspection Report.

Approval Items "E. Water Disposal", item 34, through the "Remarks" section are contained on the fourth (ACL-24) screen.

Entering Remarks on the Inspector's List

The Remarks fields are for any explanations that are needed. Insert the checklist line number and the explanation. Example: B.11 Estimated.

NOTE: If a HAZARD (as defined in the Header Record) exists, enter a remark(s) that fully explains the nature of the hazard. If the hazard pertains to a particular well, make note of it here and on the well record remarks. For example: F36 H2S, well 4-2 and 4-5.

Entering the Inspector's List on the Computer

If you wish to review data, you can toggle between screen(s), by pressing the **F7** or **F8** key. When you have completed updating the inspector's list, press the **[ENTER]** key to save your changes. The computer will then return you to the beginning Inspector's List screen (ACL-00).

If you **do not want to save your changes**, press the **[F2]** key to escape back to the Inspector's List Screen (ACL-00) or press the **[F3]** key to return to the Main Menu.

Exiting the Inspector's List Data Entry Screen

From the Inspector's List Screen (ACL-00), press the **[F3]** key to return to the Main Menu.

Correcting Errors

Error messages will appear anytime an incorrect entry is made in an *edited* field. Edited fields will display entered data using green characters; the cursor will also be green.

Any error in an edited field must be corrected before the system will accept your data. The error messages appear in red at the bottom of the DES.

Errors made in unedited fields that are accepted by the computer may be corrected by repeating the steps in this Section.

3.3 Entering a New Report

3.3.4 Entering the Inspection History

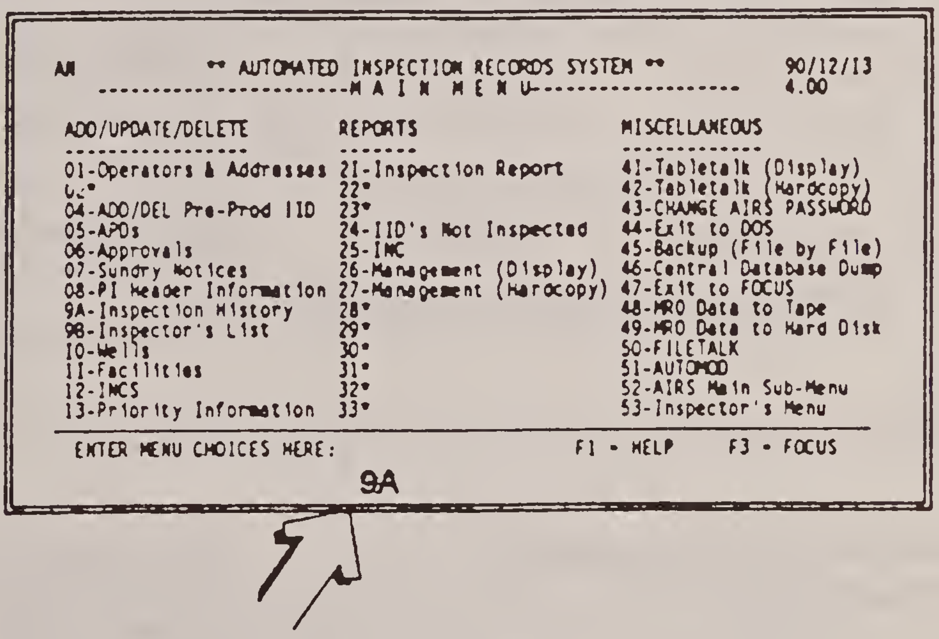
Entering Inspection History Information (Introduction)

When the Inspection Report is printed, a Blank Inspection History Information form is printed at the top of the second page of the Inspection Report. Statistics and other information about a New Inspection are annotated on the blank form. Just below the New Inspection History, the histories of all previous inspections are printed out. The Inspection Report may be returned to a data entry person as an input form to make changes to AIRS by the Inspector. Any new history or changes to previous history can be entered by using the Main Menu Inspection History feature, 9A.

You may have several inspections for an IID, each needing to be entered. AIRS is designed to assist you by retaining some data fields while adding inspection history. Details are provided later in this section.

NOTE: The WO is reviewing policy and procedures for this section; consult current guidance before entering the Inspection History.

From the Main Menu:



```
AN            ** AUTOMATED INSPECTION RECORDS SYSTEM **            90/12/13
     ------------------------M A I N  M E N U--------------------  4.00

ADD/UPDATE/DELETE        REPORTS                     MISCELLANEOUS
-----------------        -------                     -------------
01-Operators & Addresses 21-Inspection Report        41-Tabletalk (Display)
02*                      22*                         42-Tabletalk (Hardcopy)
04-ADD/DEL Pre-Prod IID  23*                         43-CHANGE AIRS PASSWORD
05-APDs                  24-IID's Not Inspected      44-Exit to DOS
06-Approvals             25-INC                      45-Backup (File by File)
07-Sundry Notices        26-Management (Display)     46-Central Database Dump
08-PI Header Information 27-Management (Hardcopy)    47-Exit to FOCUS
9A-Inspection History    28*                         48-MRO Data to Tape
9B-Inspector's List      29*                         49-MRO Data to Hard Disk
10-Wells                 30*                         50-FILETALK
11-Facilities            31*                         51-AUTOMOD
12-INCS                  32*                         52-AIRS Main Sub-Menu
13-Priority Information  33*                         53-Inspector's Menu
----------------------------------------------------------------------------
 ENTER MENU CHOICES HERE:                        F1 - HELP     F3 - FOCUS
              9A
```

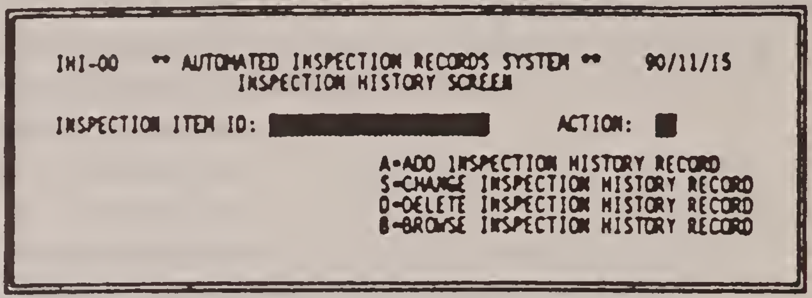
Type **9A** in the area *ENTER MENU CHOICES HERE:* at the bottom of the Main Menu screen.

Press the [ENTER] key.

3.3 Entering a New Report

3.3.4 Entering the Inspection History

The following screen (IHI-00) is displayed:



```
IHI-00   ** AUTOMATED INSPECTION RECORDS SYSTEM **    90/11/15
                 INSPECTION HISTORY SCREEN

INSPECTION ITEM ID:                      ACTION:

                                A•ADD INSPECTION HISTORY RECORD
                                S-CHANGE INSPECTION HISTORY RECORD
                                D-DELETE INSPECTION HISTORY RECORD
                                B-BROWSE INSPECTION HISTORY RECORD
```

Entering the Inspection Item ID (IID) and Action Code

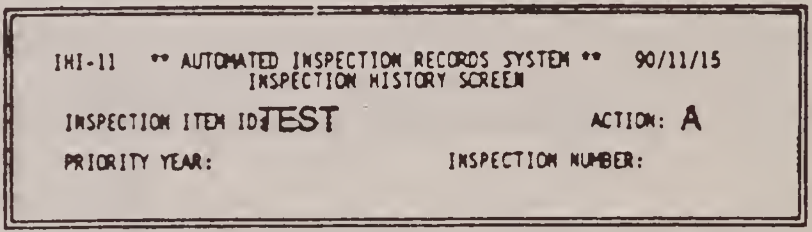
From the Inspection History Screen you are asked to input (1) an Inspection Item ID and (2) an action code. The Inspection Item ID is found on the upper left portion of the Inspection Report.

Type the Inspection Item ID in the *INSPECTION ITEM ID:* field.

Press the [TAB] key and type an A in the *ACTION:* field.

Press the [ENTER] key.

The following screen (IHI-11) is displayed.



```
IHI-11   ** AUTOMATED INSPECTION RECORDS SYSTEM **   90/11/15
                  INSPECTION HISTORY SCREEN
 INSPECTION ITEM ID:TEST                           ACTION: A
 PRIORITY YEAR:                  INSPECTION NUMBER:
```

Entering the Priority Year and the Inspection Number

From the Inspection History Screen (IHI-11), you are asked to input the priority year and inspection number. This information is found in the first line at the top of the Inspection History portion of the Inspection Report.

Type the Priority Year in the *PRIORITY YEAR:* field.

3.3 Entering a New Report

3.3.4 Entering the Inspection History

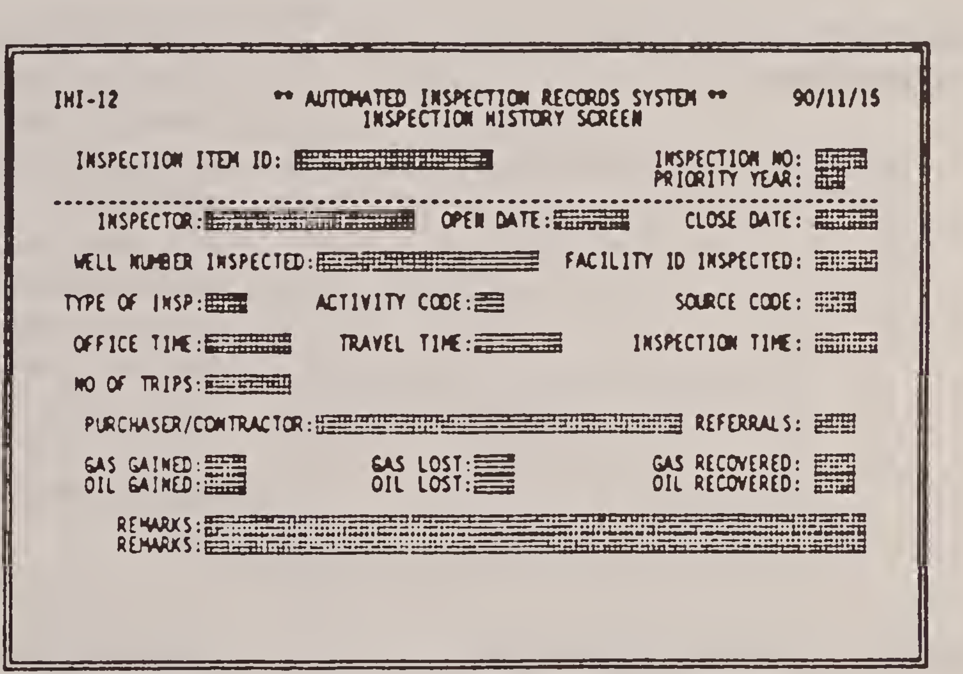
The Inspection Number is a five-digit number that is unique to the priority year for each IID. It is a required field in AIRS.

NOTE: The Inspection Number in concert with the priority year is the unique field for an inspection record for an IID. You will need both numbers to retrieve an inspection record; therefore, it is recommended that local offices track the assignment and use of inspection numbers for each IID. The numbers can be also found using the Browse features (Section 3.5).

Enter the Inspection Number in the *INSPECTION NUMBER:* field.

Press the **[ENTER]** key.

The IHI-12 screen is displayed:



```
IHI-12              ** AUTOMATED INSPECTION RECORDS SYSTEM **        90/11/15
                          INSPECTION HISTORY SCREEN
  INSPECTION ITEM ID:                                     INSPECTION NO:
                                                          PRIORITY YEAR:
-------------------------------------------------------------------------------
    INSPECTOR:                    OPEN DATE:                 CLOSE DATE:
  WELL NUMBER INSPECTED:                           FACILITY ID INSPECTED:
 TYPE OF INSP:          ACTIVITY CODE:                       SOURCE CODE:
  OFFICE TIME:            TRAVEL TIME:                   INSPECTION TIME:
  NO OF TRIPS:
   PURCHASER/CONTRACTOR:                                      REFERRALS:
   GAS GAINED:               GAS LOST:                    GAS RECOVERED:
   OIL GAINED:               OIL LOST:                    OIL RECOVERED:
      REMARKS:
      REMARKS:
```

Entering the Inspector

Enter the name(s) of the inspector(s) who conducted this inspection. Be consistent in the spelling, use of initials, etc., for each name throughout the data base. Separate multiple inspector's names or initials by slashes (/). This field is a required field in AIRS.

Type the inspector name(s) in the *INSPECTOR:* field.

3.3 Entering a New Report

3.3.4 Entering the Inspection History

Entering the Open Date

The Open Date is the date the inspection was actually started; use the YYMMDD format. This is a required field in AIRS.

Type the Open Date in the *OPEN DATE:* field.

Entering the Close Date

The Close Date is the date the inspection was completed. This is a required field in AIRS.

Type the Close Date in the *CLOSE DATE:* field.

NOTE: Additional information on open and close dates can be found in WO IM-90-23.

Entering the Well Number of an Inspected Well

The Well Number Inspected field is used to record the number of the well that was inspected if the inspection related to a single well on the IID, such as in a drilling or a well test inspection. If the inspection was conducted on more than one well site on the IID, enter the total number of wells inspected as a numeral; for example, if three wells were inspected, enter a "3." On the other hand, if a single well was inspected, the well number, preceded by "#," (e.g., #3 or #3-15A) would be entered. This is a required field in AIRS.

Type the Well Number in the *WELL NUMBER INSPECTED:* field.

Entering the Facility ID Inspected

The Facility ID Inspected field is used to record the Facility Identifier of the item that was inspected if the inspection related to a single facility on the IID, such as in a tank gauging, meter proving, or sales witnessing inspection. If the inspection was conducted for more than one facility on the IID, enter the total number of facilities as a numeral; for example, if three facilities were inspected, enter a "3." On the other hand, if a single facility was inspected, the facility identification (e.g., #A, #1, or #B) would be entered. This is a required field in AIRS.

Type the Facility Identifier in the *FACILITY ID INSPECTED:* field.

3.3 Entering a New Report

3.3.4 Entering the Inspection History

Entering the Type of Inspection

The Type of Inspection is part one of a two-part data set that is used to describe an inspection. The Activity Code is part two of the set and is described in the next step. In some cases, only the Inspection Type is used; the Inspection Activity Code is left blank. The exact uses of the Type of Inspection and Inspection Activity fields are subject to specific guidance from the Washington Office. Refer to any applicable Washington Office guidance on the use of these fields. Both are required fields in AIRS.

NOTE: The Inspection Type and Activity Codes correspond directly to specific lines on the Matrix for the Inspection Strategy. WO-612 will provide definitions for these fields.

The new valid codes are:

DW - Drilling well inspection
ND - Non-detailed drilling inspection
ES - Environmental/surface inspection
NR - Non-routine environmental/surface inspection
NU - Non-detailed undesirable event (this code is valid both before and after 90/10/01)
PD - Plugging/abandonment well inspection (downhole only)
PA - Production accountability inspection
PH - Production handling inspection
PV - Production verification inspection
RV - Records (volume) verification inspection
TH - Theft inspection
WT - Well test inspection

Type the appropriate Type of Inspection code in the *TYPE OF INSP:* field.

The system allows the old Inspection Type Codes only on inspections opened prior to 90/10/01, and only the new codes for Inspections opened on or after 90/10/01. See valid code list for old codes in Appendix A.

3.3 Entering a New Report

3.3.4 Entering the Inspection History

Entering the Activity Code

The Activity Code is part two of a data set that describes an inspection. Part one of the data set is the Type of Inspection, which is described above. This is a required field in AIRS. Valid codes are:

BO - Blow out prevention equipment inspection
C - Cementing well inspection
CS - Casing test inspection
CV - Gas chart verification
DS - Drill stem test
FI - Follow-up inspection (not INC-related)
HS - Health and safety inspection
MC - Meter (gas) calibration
MP - Meter (oil) proving
O - Other (explain in remarks)
PB - Plug back inspection
PC - Prover/master meter certification
PD - Plugging of depleted producer/service well
PN - Plugging of a non-completed well
PR - Production records check
RD - Royalty rate determination
RR - Record review (after an inspection)
SA - Surface inspection - abandonment
SD - Surface inspection - drilling
SP - Surface inspection - production
SR - Surface inspection - restoration
SS - Site security inspection
T - Well test inspection (production/completion)
TG - Tank (oil) gauging
TR - Transporter inspection
TV - Run ticket verification
WK - Workover
BLANK

Type the appropriate Activity Code in the *ACTIVITY CODE:* field.

3.3 Entering a New Report

3.3.4 Entering the Inspection History

Entering the Source Code

A Source code is used to identify who prompted the inspection.

Valid codes (system defaults to BLM) are:

BIA - Bureau of Indian Affairs
FS - United States Forest Service
MMS - Mineral Management Service
TRB - Tribal
BLM - Bureau of Land Management
LE - Law enforcement
OTH - Other

Type the appropriate Source Code in the *SOURCE CODE:* field.

Entering the Office Time

The Office Time is the amount of time required to review files and prepare for the inspection. If more than one inspection was prepared for, the time should be prorated equally among each inspection. Enter the time in hours and tenths of hours (e.g., 1.0, 1.1, or 4.5). This is a required field in AIRS.

Type the Office Time in the *OFFICE TIME:* field.

Entering the Travel Time

The Travel Time is the amount of time required to travel from the office to the inspection and to return to the office. Enter the time in hours and tenths of hours (e.g., 1.0, 1.1 or 4.5). If more than one inspection was traveled to at a time, prorate the time spent traveling from office to inspection site equally to each inspection. Travel time between inspections is credited to the inspection traveled to. Travel time back to the office is prorated equally to all inspections done that day or in that trip. This is a required field in AIRS.

Type the Travel Time in the *TRAVEL TIME:* field.

Entering the Inspection Time

The Inspection Time is the amount of time that was required to conduct the inspection. Enter the time in hours and tenths of hours (e.g., 1.0, 1.1, or 4.5). If more than one inspection was conducted at a time, prorate the time equally to each inspection. This is a required field in AIRS.

Type the Inspection Time in the *INSPECTION TIME:* field.

3.3 Entering a New Report

3.3.4 Entering the Inspection History

Verifying the Total Time

There is no field for Total Time on the IHI-12 data entry screen. The computer automatically calculates the Total Time, so no entry is required or permitted. The calculation is based on the sum of the Office time plus the Travel time plus the Inspection Time. This field may be viewed on screen when using the Browse feature for Inspection History and is printed in the Inspection Reports (Section 3.8.1). You can also calculate this field in TABLETALK, using the 'sum calculated values' feature.

Entering the Number of Trips

The Number of Trips field is used to indicate the number of trips that were required to complete this inspection. This number does not include follow-up trips as a result of INCs or other enforcement actions. Follow-up trips are tacked on the INC record in AIRS. This is a required field in AIRS.

Type the Number of Trips in the *NO OF TRIPS:* field.

Entering the Purchaser/Contractor

The name of the product purchaser or the name of the drilling/workover/plugging contractor that relates to this inspection, not the IID, is entered in the Purchaser/Contractor field.

Type the appropriate name in the *PURCHASER/CONTRACTOR:* field.

Entering Referrals

The Referral field is used when an Inspection is referred to another agency or to BLM Law Enforcement for their consideration. For example: If an inspection resulted in a recommendation for an audit by the MMS, then the referral field would be coded with MMS. If an inspection resulted in a criminal investigation involving law enforcement, then the referral field would be coded with LE. If no referrals are made, the field is left blank. Valid codes are:

LE - BLM Law Enforcement
MMS - Minerals Management Service
BIA - Bureau of Indian Affairs
STC - State Tax Commission or Similar State Agency for Audits
blank - No referral

Type the appropriate code in the *REFERRAL:* field.

3.3.4 Entering the Inspection History

Entering the Gas Gained, Lost, or Recovered

A Production Inspection might detect a difference in gas volumes reported by the Operator.

If the inspector detects a gain or an increase in reported gas production, enter that volume in MCF in whole numbers with no commas in the *GAS GAINED:* field.

If the inspector detects a loss or a decrease in reported gas production, enter that volume in MCF in whole numbers with no commas in the *GAS LOST:* field.

If the inspection results in a finding that the operator will receive a gas credit (additional production/sales), enter that volume in MCF in whole numbers with no commas in the *GAS RECOVERED:* field.

Entering the Oil Gained, Lost, or Recovered

A Production Inspection might also detect a difference in volumes reported by the Operator.

If the inspector detects a gain or an increase in reported oil production, enter that volume in BBLS in whole numbers with no commas in the *OIL GAINED:* field.

If the inspector detects a loss or a decrease in reported oil production, enter that volume in BBLS in whole numbers with no commas in the *OIL LOST:* field.

If the inspection results in a finding that the operator will receive an oil credit (additional production/sales), enter that volume in BBLS in whole numbers with no commas in the *OIL RECOVERED:* field.

Entering Remarks

Enter any Remarks applicable to this inspection. There are two fields of 60 characters each.

Type the appropriate Remarks in the *REMARKS:* fields

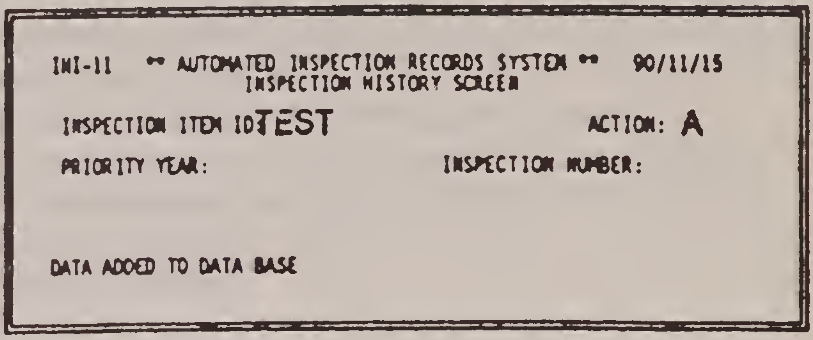
Entering the Inspection History onto the Computer

Press the [ENTER] key to enter all data on the screen on to the database.

3.3 Entering a New Report

3.3.4 Entering the Inspection History

If the data is accepted, the following screen (IHI-11) will be displayed with a message across the bottom:



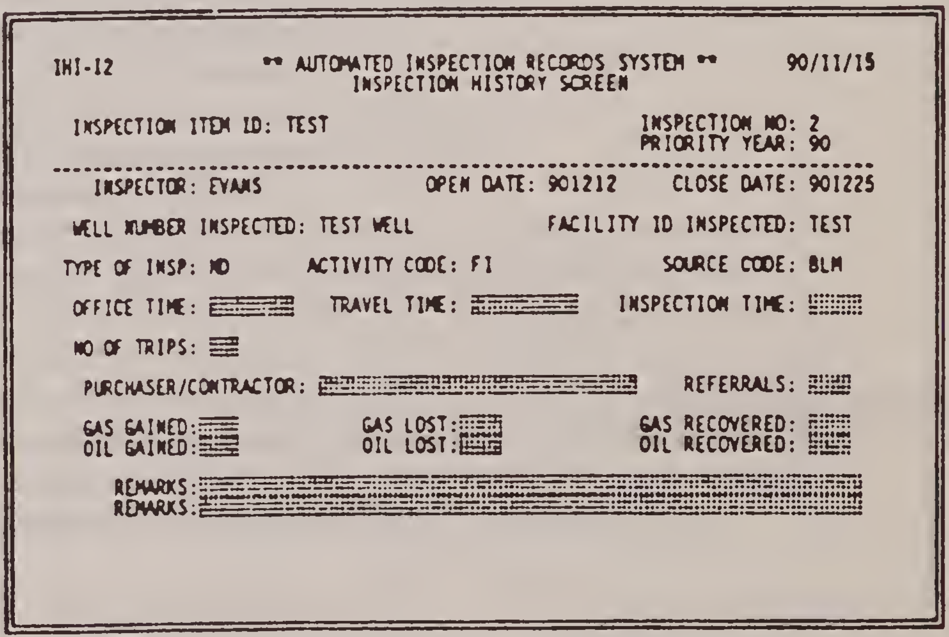
```
IHI-11    ** AUTOMATED INSPECTION RECORDS SYSTEM **    90/11/15
                  INSPECTION HISTORY SCREEN
 INSPECTION ITEM ID:TEST                          ACTION: A
 PRIORITY YEAR:                    INSPECTION NUMBER:


DATA ADDED TO DATA BASE
```

Entering Additional Inspection History Records

This screen (IHI-11) allows other inspections for the Inspection item displayed to be entered, if desired.

Update the Priority Year field, if necessary, to the correct year and then input the inspection number of the Inspection History you wish to add.

Press the [ENTER] key. The following screen (IHI-12) will be displayed:



```
IHI-12          ** AUTOMATED INSPECTION RECORDS SYSTEM **        90/11/15
                         INSPECTION HISTORY SCREEN

 INSPECTION ITEM ID: TEST                              INSPECTION NO: 2
                                                       PRIORITY YEAR: 90
----------------------------------------------------------------------------
   INSPECTOR: EVANS                 OPEN DATE: 901212     CLOSE DATE: 901225

 WELL NUMBER INSPECTED: TEST WELL              FACILITY ID INSPECTED: TEST

TYPE OF INSP: NO       ACTIVITY CODE: FI                  SOURCE CODE: BLM

 OFFICE TIME:            TRAVEL TIME:              INSPECTION TIME:

 NO OF TRIPS:

  PURCHASER/CONTRACTOR:                                    REFERRALS:

  GAS GAINED:                 GAS LOST:                GAS RECOVERED:
  OIL GAINED:                 OIL LOST:                OIL RECOVERED:

     REMARKS:
     REMARKS:
```

NOTE: The data in the data fields listed below have been retained from the previously entered inspection. This feature is designed to eliminate keystrokes in entering multiple inspections for the same IID.

Inspector: Open Date: Close Date:

Well Number Inspected: Facility ID Inspected:

Type of Insp.: Activity Code: Source Code:

Purchaser/Contractor:

Update all the fields on screen IHI-12 following the steps previously given, beginning with the 'Entering the Inspector' step:

Exiting the Inspection History Screen(s)

AIRS allows you to choose where you wish to exit to. You may exit back to the Inspection History Screen (IHI-00) or to the Main Menu.

If you wish to add, change, delete, or browse Inspection History Records:

Press the **[F2]** key. The Inspection History Screen (IHI-00) will appear.

If you wish to return to the Main Manu:

Press the [F3 key. The AIRS Main Menu will appear.

Correcting Errors

Error messages will appear anytime an incorrect entry is made in an *edited* field. Edited fields will display entered using green characters; the cursor will also be green.

Any error in an edited field must be corrected before the system will accept your data. The error messages appear in red at the bottom of the DES.

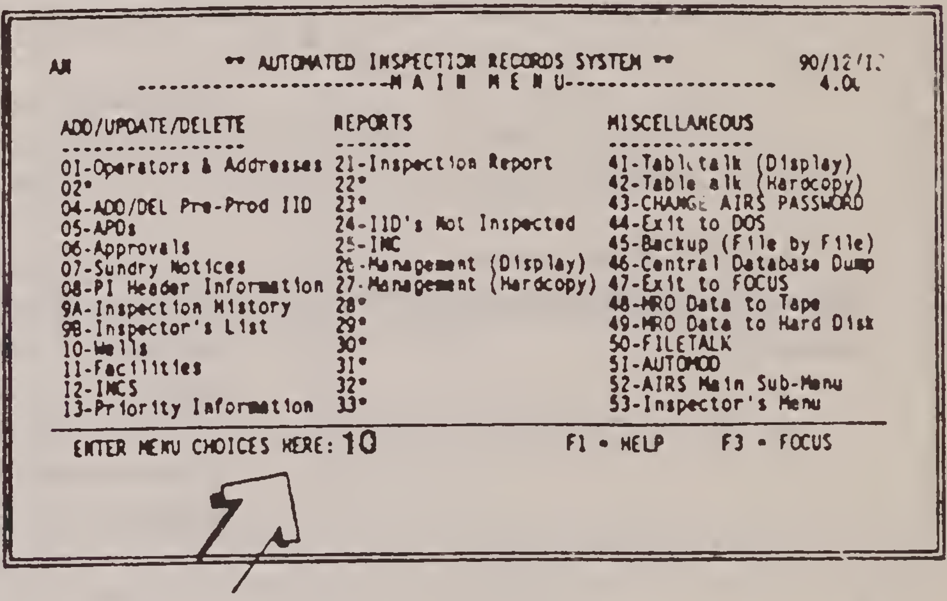
Errors made in unedited fields that are accepted by the computer may be corrected by using the Change Inspection History Record (S) option of the Inspection History IHI-00 Screen.

3.3.5 Updating Well/Completion Records

Updating Well/Completion Records (Introduction)

The Inspection Report contains a printout of all well/completion records for the IID. Enter any annotations made by the inspector using the Specific Well (S) feature of AIRS. As stated in the Overview of this section, it is assumed that a well/completion record exists. If the well/completion record does not exist, refer to Section 3.2.3 for detailed instructions on how to enter the missing record.

From the Main Menu:

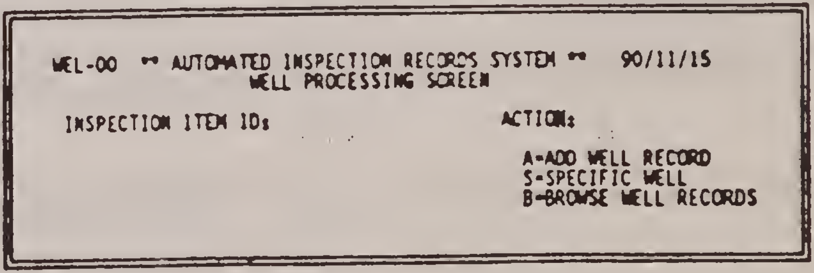


```
AM          ** AUTOMATED INSPECTION RECORDS SYSTEM **              90/12/1
            -----------------------M A I N  M E N U------------------   4.0

ADD/UPDATE/DELETE        REPORTS                     MISCELLANEOUS
-----------------        -------                     -------------
01-Operators & Addresses 21-Inspection Report        41-Tabl talk (Display)
02*                      22*                         42-Table alk (Hardcopy)
04-ADD/DEL Pre-Prod IID  23*                         43-CHANGE AIRS PASSWORD
05-APDs                  24-IID's Not Inspected      44-Exit to DOS
06-Approvals             25-INC                      45-Backup (File by File)
07-Sundry Notices        26-Management (Display)     46-Central Database Dump
08-PI Header Information 27-Management (Hardcopy)    47-Exit to FOCUS
9A-Inspection History    28*                         48-MRO Data to Tape
9B-Inspector's List      29*                         49-MRO Data to Hard Disk
10-Wells                 30*                         50-FILETALK
11-Facilities            31*                         51-AUTOMOD
12-INCS                  32*                         52-AIRS Main Sub-Menu
13-Priority Information  33*                         53-Inspector's Menu
------------------------------------------------------------------------
 ENTER MENU CHOICES HERE: 10                      F1 = HELP     F3 = FOCUS
```

Type **10** in the area *ENTER MENU CHOICES HERE:* at the bottom of the Main Menu screen.

Press the [ENTER] key.

The WEL-00 screen is displayed:



```
WEL-00  ** AUTOMATED INSPECTION RECORDS SYSTEM **   90/11/15
                 WELL PROCESSING SCREEN

 INSPECTION ITEM IDs                      ACTION:

                                            A=ADD WELL RECORD
                                            S=SPECIFIC WELL
                                            B=BROWSE WELL RECORDS
```

3.3.5 Updating Well/Completion Records

Entering an Inspection Item ID (IID) and Action Code

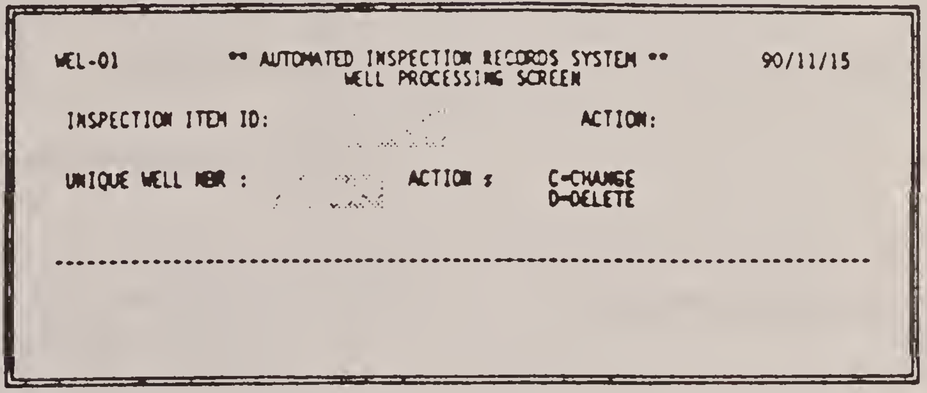
From the Well Processing Screen you are asked to input (1) an Inspection Item ID for which you wish to check or update the Well Record and (2) an Action code.

Type the Inspection Item ID you wish to update the well records for in the *INSPECTION ITEM ID:* field.

Press the **[TAB]** key and type **S** in the *ACTION:* field.

Press the **[ENTER]** key.

The WEL-01 screen is displayed:



```
WEL-01         ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/11/15
                        WELL PROCESSING SCREEN

 INSPECTION ITEM ID:                              ACTION:

 UNIQUE WELL NBR :            ACTIONS     C-CHANGE
                                          D-DELETE

-------------------------------------------------------------------------
```

Entering the Unique Well Number

The unique well number is printed out just to the left of the API NO.: field on the Inspection Report. The unique well number is a number assigned to every well/completion for this IID. Additional details about the unique number can be found in section 3.2.3.

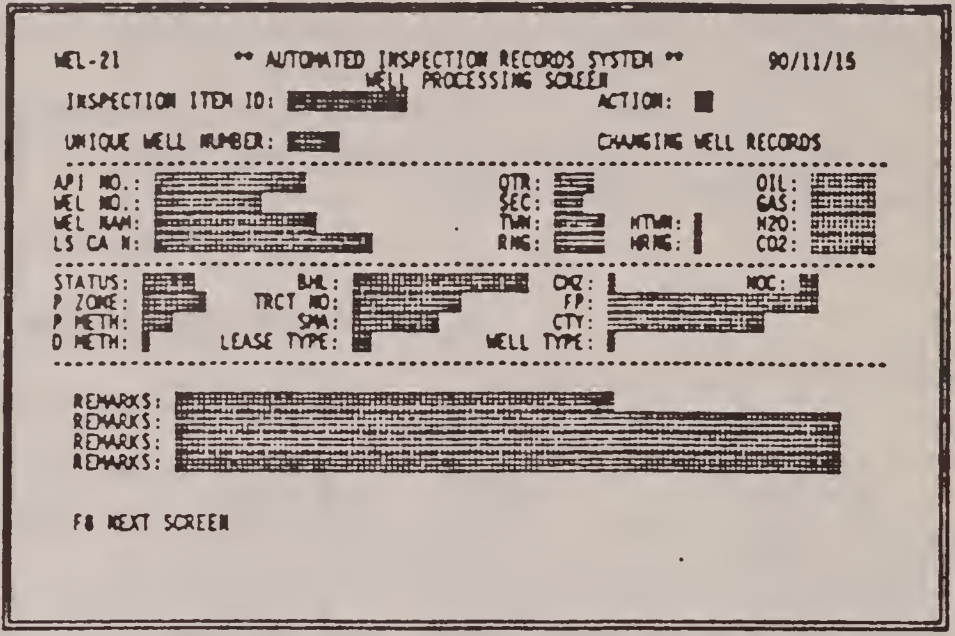
Type the unique number in the *UNIQUE WELL NBR:* field.

Type **C** in the *ACTION:* field. Press the **[ENTER]** key.

3.3 Entering a New Report

3.3.5 Updating Well/Completion Records

The WEL-21 screen is displayed.



```
WEL-21          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/11/15
                            WELL PROCESSING SCREEN
 INSPECTION ITEM ID:                                    ACTION:

 UNIQUE WELL NUMBER:                                    CHANGING WELL RECORDS
...........................................................................
API NO.:                                  QTR:                       OIL:
WEL NO.:                                  SEC:                       GAS:
WEL NAM:                                  TWN:          HTWN:        H2O:
LS CA N:                                  RNG:          HRNG:        CO2:
...........................................................................
STATUS:              BHL:                 CKZ:                 NOC:
P ZONE:          TRCT NO:                  FP:
P METH:              SMA:                 CTY:
O METH:       LEASE TYPE:           WELL TYPE:
...........................................................................

 REMARKS:
 REMARKS:
 REMARKS:
 REMARKS:

 F8 NEXT SCREEN
```

Updating the Well/Completion Records

Using the annotations on the Inspection Report as a guide, make the appropriate changes/updates to the well record. If you need additional information about the Well Record, refer to Section 3.2.3 of this handbook. Guidance is also provided in WO IM No. 90-23.

If you make any changes to the *API NUMBER*, record the old number in the first line of remarks. For example: OLD API 470230005000X1. MMS uses this information in updating their system.

The system will require you to make an entry in the *LAST EFFECTIVE DATE FOR MMS CHANGES:* field if you make changes to the following fields:

API NO.: *WELL NO.* *WELL NAM:* *LS CA N:*

STATUS: *TWN:* *HTWN:* *RNG:*

HRNG: *SEC:* *QTR:*

Type any changes annotated on the Inspection Report in the appropriate fields.

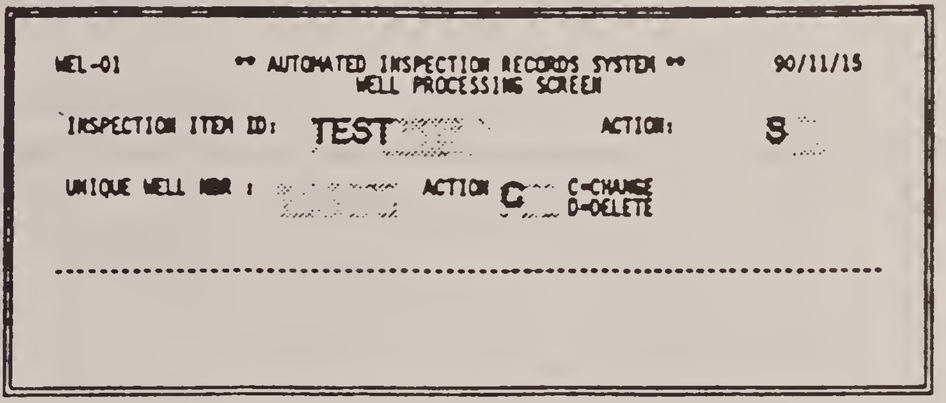
3.3 Entering a New Report

3.3.5 Updating Well/Completion Records

Entering the Data onto the Computer

Press the [ENTER] key to enter all data on the screen onto the data base itself.

If the data is accepted, the WEL-01 screen is displayed:



```
WEL-01          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/11/15
                          WELL PROCESSING SCREEN
 INSPECTION ITEM ID:  TEST                         ACTION:        S

 UNIQUE WELL NBR :               ACTION  C   C-CHANGE
                                             D-DELETE

-------------------------------------------------------------------------
```

Entering Additional Well Records

This screen allows other Well Records to be selected by entering the Unique Number if desired.

Follow the steps previously given, beginning with the "Entering the Unique Well Number" step.

Exiting the Change Well Processing Screen

AIRS allows you to choose where you wish to exit to. You may exit back to the Well Processing Menu Screen (WEL-01) or to the Main Menu.

If you wish to change or delete other Well Records:

Press the [F2] key. The Well Processing Screen (WEL-01) should appear or be refreshed.

If you wish to return to the Main Menu:

Press the [F3] key. The AIRS Main Menu should appear.

3.3.5 Updating Well/Completion Records

Correcting Errors

Error messages will appear anytime an incorrect entry is made in an *edited* field. Edited fields will display entered data using green characters; the cursor will also be green.

Any error in an edited field must be corrected before the system will accept your data. The error messages appear in red at the bottom of the DES.

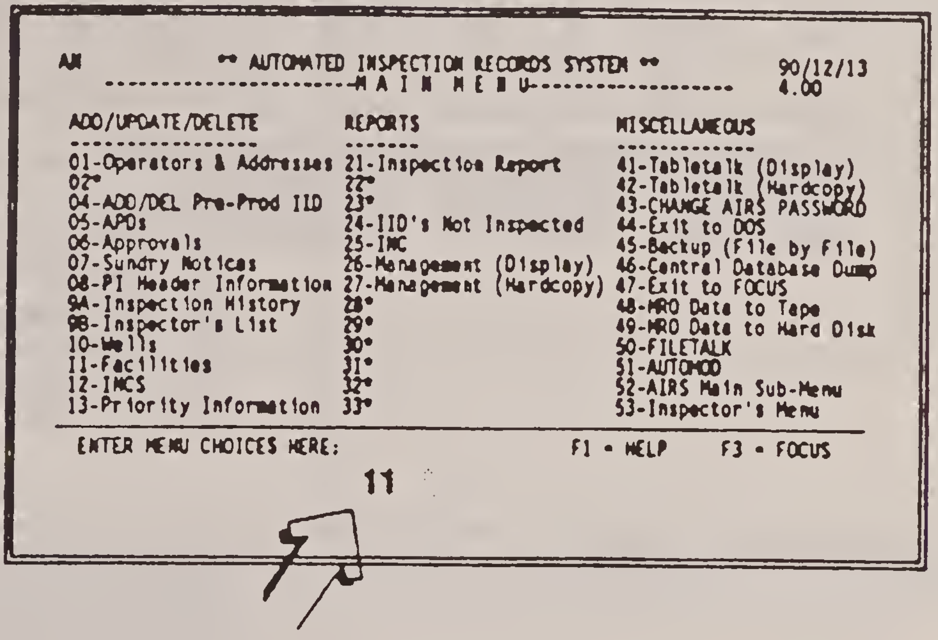
Errors made in unedited fields that are accepted by the computer may be corrected by using the Specific Well (S) option of the WELL PROCESSING (WEL-00) Screen or Change (C) option at the WELL PROCESSING (WEL-01) screen.

3.3 Entering a New Report 3.3.6 Updating Facility Records

Updating Facility Records (Introduction)

The Inspection Report contains a printout of all facility records for the IID. You enter any annotations made by the inspector using the Specific Facility (S) feature of AIRS. As stated in the Overview of this section, it is assumed that a facility record exists. If the facility record does not exist, refer to Section 3.2.4 for detailed instructions how to enter the missing record.

From the Main Menu:

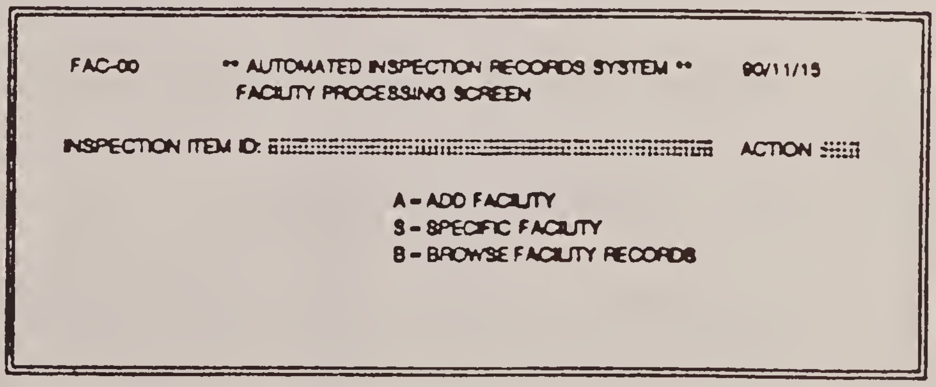


```
AM          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/12/13
    ----------------------M A I N  M E N U------------------   4.00

ADD/UPDATE/DELETE          REPORTS                   MISCELLANEOUS
-----------------          -------                   -------------
01-Operators & Addresses 21-Inspection Report       41-Tabletalk (Display)
02*                      22*                        42-Tabletalk (Hardcopy)
04-ADD/DEL Pre-Prod IID  23*                        43-CHANGE AIRS PASSWORD
05-APDs                  24-IID's Not Inspected     44-Exit to DOS
06-Approvals             25-INC                     45-Backup (File by File)
07-Sundry Notices        26-Management (Display)    46-Central Database Dump
08-PI Header Information 27-Management (Hardcopy)   47-Exit to FOCUS
9A-Inspection History    28*                        48-MRO Data to Tape
9B-Inspector's List      29*                        49-MRO Data to Hard Disk
10-Wells                 30*                        50-FILETALK
11-Facilities            31*                        51-AUTOMOD
12-INCS                  32*                        52-AIRS Main Sub-Menu
13-Priority Information  33*                        53-Inspector's Menu
------------------------------------------------------------------------
 ENTER MENU CHOICES HERE:                       F1 = HELP     F3 = FOCUS
                         11
```

Type **11** in the area *ENTER MENU CHOICES HERE:* at the bottom of the Main Menu screen.

Press the **[ENTER]** key.

The following screen (FAC-00) is displayed:



```
FAC-00       ** AUTOMATED INSPECTION RECORDS SYSTEM **      90/11/15
               FACILITY PROCESSING SCREEN

INSPECTION ITEM ID: ::::::::::::::::::::::::::::::::::::::  ACTION ::::

                           A - ADD FACILITY
                           S - SPECIFIC FACILITY
                           B - BROWSE FACILITY RECORDS
```

3.3 Entering a New Report

3.3.6 Updating Facility Records

Entering an Inspection Item ID (IID) and Action Code

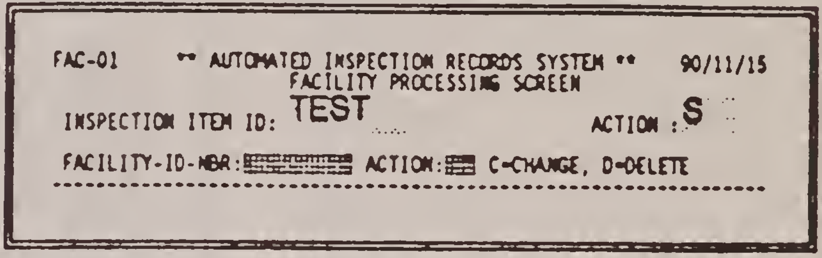
From the Facility Processing Screen you are asked to input (1) an Inspection Item ID for which you wish to check or update the Facility Record and (2) an Action code.

Type the Inspection Item IID you wish to update the facility records for in the *INSPECTION ITEM ID:* field.

Press the [TAB] key and type **S** in the *ACTION:* field.

Press the **[ENTER]** key.

The following screen (FAC-01) is displayed:



```
FAC-01     ** AUTOMATED INSPECTION RECORDS SYSTEM **     90/11/15
                  FACILITY PROCESSING SCREEN
 INSPECTION ITEM ID: TEST                         ACTION : S
 FACILITY-ID-NBR:          ACTION:    C-CHANGE, D-DELETE
---------------------------------------------------------------
```

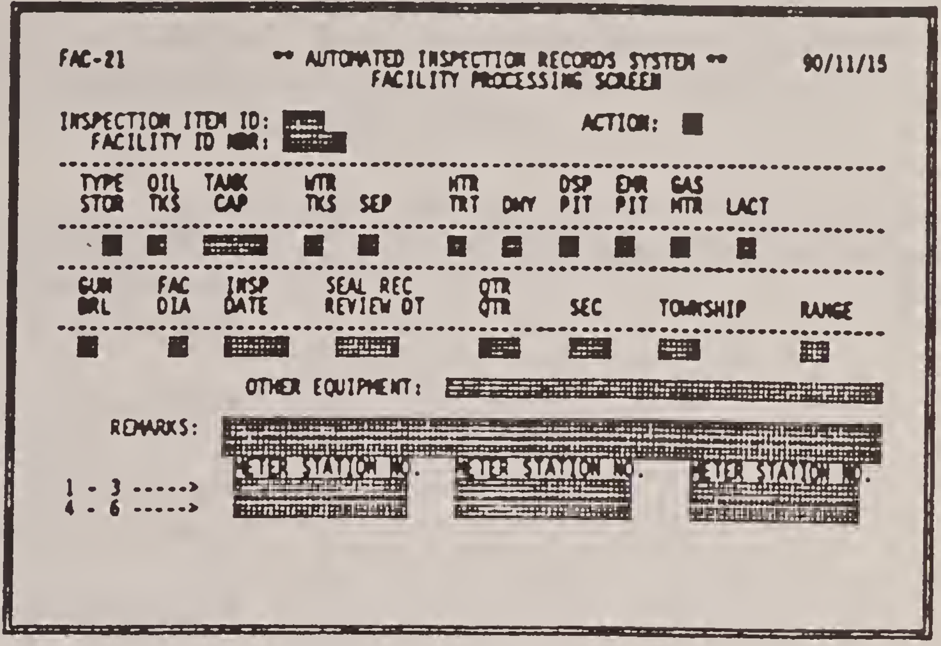
Entering the Facility Identifier

The Facility Identifier is printed out on the left under the heading 'ID' on the Inspection Report. The Facility Identifier is a unique number assigned to every facility on this IID. Additional details about the Facility Identifier can be found in section 3.2.4.

Type the Facility Identifier in the *FACILITY_ID_NBR:* field.

Type **C** in the *ACTION:* field. Press the **[ENTER]** key.

The following screen (FAC-21) will be displayed.



```
FAC-21          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/11/15
                         FACILITY PROCESSING SCREEN

INSPECTION ITEM ID:                                   ACTION:
  FACILITY ID NBR:
..........................................................................
 TYPE  OIL  TANK     WTR           HTR       DSP  EMR  GAS
 STOR  TKS  CAP      TKS   SEP     TRT  DHY  PIT  PIT  MTR  LACT
..........................................................................

..........................................................................
 GUN    FAC   INSP      SEAL REC     QTR
 BBL    DIA   DATE      REVIEW DT    QTR     SEC     TOWNSHIP     RANGE
..........................................................................

               OTHER EQUIPMENT:

       REMARKS:
              METER STATION NO.   METER STATION NO.    METER STATION NO.
 1 - 3 ----->
 4 - 6 ----->
```

Updating the Facility Record

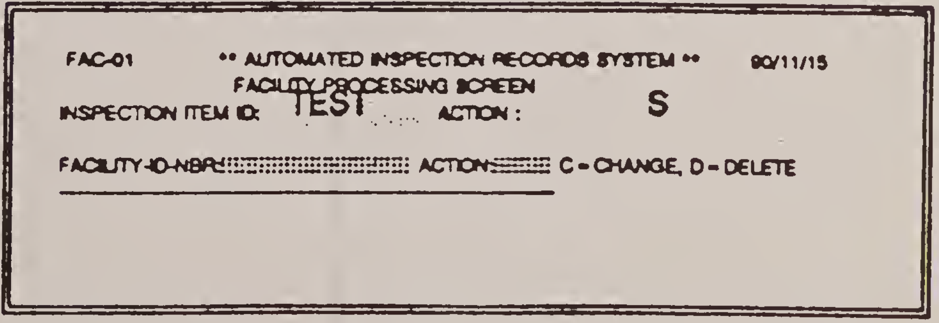
Using the annotations on the Inspection Report as a guide, make the appropriate changes/updates to the facility record. If you need additional information about the Facility Record, refer to Section 3.2.4 of this handbook.

Type in the appropriate fields any changes annotated on the Inspection Report.

Entering the Data onto the Computer

Press the [ENTER] key to enter all data on the screen onto the data base itself.

If the data is accepted, the FAC-01 screen is displayed:



```
FAC-01        ** AUTOMATED INSPECTION RECORDS SYSTEM **        90/11/15
                FACILITY PROCESSING SCREEN
INSPECTION ITEM ID:  TEST        ACTION :            S

FACILITY-ID-NBR:                 ACTION:       C = CHANGE, D = DELETE
```

Entering Additional Facility Records

This screen allows other Facility Records for the same IID to be selected by entering the Facility Identifier if desired.

Follow the steps previously given, beginning with the "Entering the Facility Identifier" step.

Exiting the Facility Processing Screen

AIRS allows you to choose where you wish to exit to. You may exit back to the Facility Processing Menu Screen (FAC-00) or to the Main Menu.

If you wish to change or delete other Facility Records:

Press the **[F2]** key. The Facility Processing Screen (FAC-00) will appear or be refreshed.

If you wish to return to the Main Menu:

Press the **[F3]** key. The AIRS Main Menu will appear.

Correcting Errors

Error messages will appear anytime an incorrect entry is made in an *edited* field. Edited fields will display entered data using green characters; the cursor will also be green.

Any error in an edited field must be corrected before the system will accept your data. The error messages appear in red at the bottom of the DES.

Errors made in unedited fields that are accepted by the computer may be corrected by using the Specific Facility (S) option of the FACILITY PROCESSING (FAC-00) Screen or Change (C) option of the FACILITY PROCESSING (FAC-01) screen.

3.3.7 Entering Incidents of Non-Compliance

Entering Incidents of Non-Compliance Records

Any Incidents of Non-Compliance (INCs) which do not have a correction date entered on the INC Record will be printed out on the Inspection Report. Since not all inspections result in Incidents of Non-Compliance (INC), this will be covered in a separate section, Section 3.7, of this Handbook.

If you need to update or add INC records, refer to Section 3.7, Entering a Non-Compliance Record (INC).

3.3.8 Entering Approval Records

Entering Approval Records

A summary of all approval records for this IID is printed out on the Inspection Report. Entering of Approval Records is covered in Section 3.2.5 of this Handbook.

If you need to add Approval records, please refer to Section 3.2.5, Entering an Approval Record.

3.7 Entering an INC

Overview

This section describes how to enter a Non-Compliance Record (INC). The BLM issues the Notice of Incidents of Noncompliance, Form 3160-9, to operators for violations of the operating regulations. The Bureau may also use letters or give oral orders. Each violation must be corrected by the operator within the prescribed time from receipt of the notice and the corrective action must be reported back to the BLM. Failure to take corrective action in the time frames specified can subject the operator to additional assessments and/or civil penalties. The operator may request a review of the INC by the State Director and/or may appeal the INC to the Interior Board of Land Appeals. AIRS provides a means of tracking and documenting the INC throughout this process. Additional information on Oil & Gas Enforcement Policy & Procedures can be found in WO IM 90-554.

The Notice of Incidents of Noncompliance Form 3160-9 is a primary source of information to complete the AIRS record. You should also be familiar with your office's policy regarding the issuance and tracking of INCs, letters, and oral orders.

Incidents of Noncompliance correction and reporting time frames and other dates are tracked in AIRS. In addition to providing information on an individual INC, AIRS provides information about the total number and nature of the violations on individual Inspection items. This information is used to determine the priority for future inspections, based on operator noncompliance ratings. INC data is also used to generate reports, some of which are used by management to evaluate program objectives.

It is assumed in this section that the header and priority records exist for the IID. If these records do not exist, refer to Section 3.2 for detailed instructions on how to enter them.

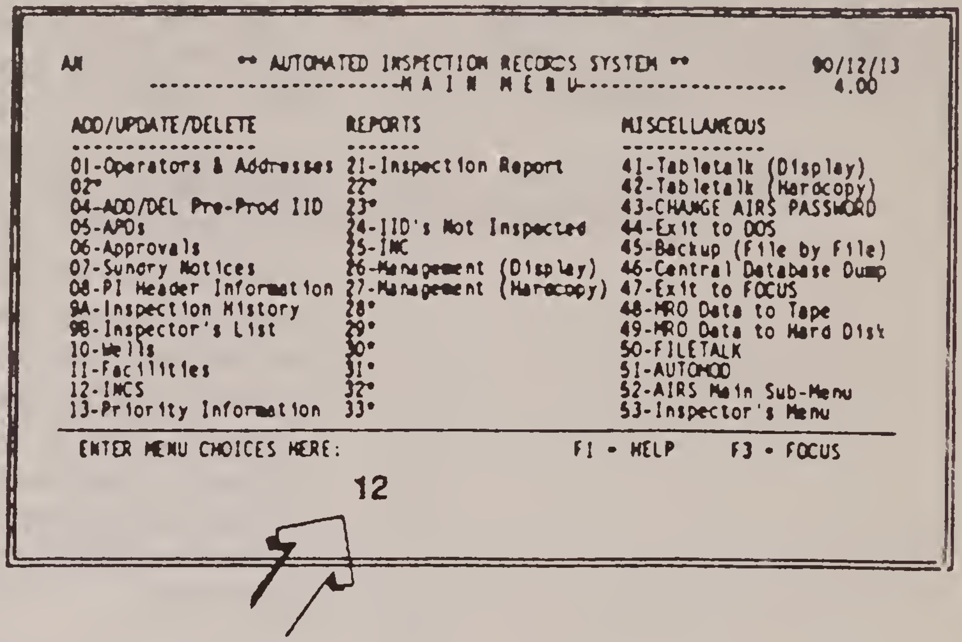
In this section you will use the add feature to enter the INC information; detailed instructions will be provided. Instructions for using the [TAB] key to move between data fields have generally been omitted from the tutorial; be sure you know this procedure. It is assumed that you have a good working knowledge of the Oil and Gas program, including the definitions and correct use of data fields. If you are not well versed in the I&E program, be sure to seek help before attempting to enter, modify, or delete data.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

Adding a Non-Compliance Record (INC) (Introduction)

From the Main Menu:

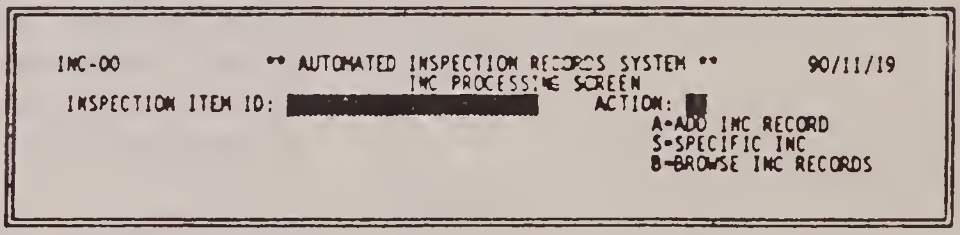


```
AH            ** AUTOMATED INSPECTION RECORDS SYSTEM **              90/12/13
          -----------------------M A I N  M E N U------------------    4.00

ADD/UPDATE/DELETE         REPORTS                     MISCELLANEOUS
-----------------         -------                     -------------
01-Operators & Addresses  21-Inspection Report        41-Tabletalk (Display)
02*                       22*                         42-Tabletalk (Hardcopy)
04-ADD/DEL Pre-Prod IID   23*                         43-CHANGE AIRS PASSWORD
05-APDs                   24-IID's Not Inspected      44-Exit to DOS
06-Approvals              25-INC                      45-Backup (File by File)
07-Sunory Notices         26-Management (Display)     46-Central Database Dump
08-PI Header Information  27-Management (Hardcopy)    47-Exit to FOCUS
9A-Inspection History     28*                         48-MRO Data to Tape
9B-Inspector's List       29*                         49-MRO Data to Hard Disk
10-Wells                  30*                         50-FILETALK
11-Facilities             31*                         51-AUTOMOD
12-INCS                   32*                         52-AIRS Main Sub-Menu
13-Priority Information   33*                         53-Inspector's Menu
------------------------------------------------------------------------------
 ENTER MENU CHOICES HERE:                          F1 = HELP     F3 = FOCUS
```

Type **12** in the area *ENTER MENU CHOICES HERE:* at the bottom of the Main Menu screen.

Press the **[ENTER]** key.

The following screen (INC-00) is displayed:



```
INC-00          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/11/19
                             INC PROCESSING SCREEN
 INSPECTION ITEM ID:                               ACTION:
                                                       A=ADD INC RECORD
                                                       S=SPECIFIC INC
                                                       B=BROWSE INC RECORDS
```

Entering an Inspection Item ID (IID) and Action Code

From the INC Processing Screen (INC-00) you are asked to input (1) the Inspection Item ID for which you wish to add the Non-Compliance Record and (2) an Action code. The IID is found on the upper right of Form 3160-9.

Type the Inspection Item ID you wish to add the Non-Compliance record for in the *INSPECTION ITEM ID:* field.

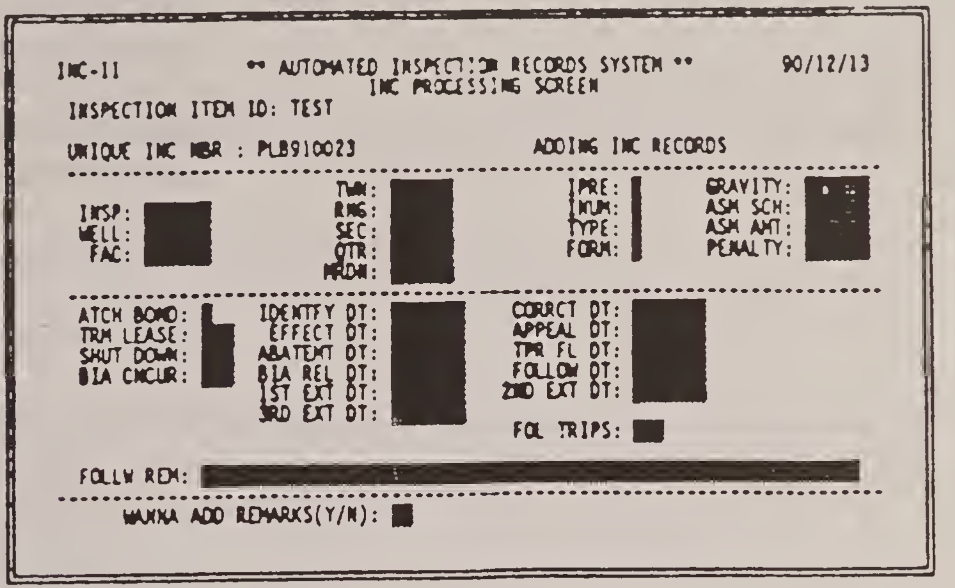
Press the [TAB] key and type **A** in the *ACTION:* field.

Press the **[ENTER]** key.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

The following screen (INC-11) is displayed:



```
INC-11          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/12/13
                            INC PROCESSING SCREEN
 INSPECTION ITEM ID: TEST

 UNIQUE INC NBR : PLB910023                    ADDING INC RECORDS
-------------------------------------------------------------------------
                        TWN:              IPRE:            GRAVITY:
  INSP:                 RNG:              INUM:            ASM SCH:
  WELL:                 SEC:              TYPE:            ASM AMT:
   FAC:                 QTR:              FORM:            PENALTY:
                       MRDN:
-------------------------------------------------------------------------
  ATCH BOND:      IDENTFY DT:           CORRCT DT:
  TRM LEASE:       EFFECT DT:           APPEAL DT:
  SHUT DOWN:      ABATEMT DT:           TPR FL DT:
  BIA CNCUR:      BIA REL DT:           FOLLOW DT:
                  1ST EXT DT:          2ND EXT DT:
                  3RD EXT DT:
                                         FOL TRIPS:

  FOLLW REM:
-------------------------------------------------------------------------
      WANNA ADD REMARKS(Y/N):
```

Entering the Unique INC Number

The Unique INC Number (up to 10 characters) of the Notice of Incidents of Noncompliance is input into the data field. Each office should establish a system for assigning unique Identification Numbers for INCs. The Unique INC Number may be found on the upper right of Form 3160-9.

It is suggested that unique numbers be made up of the Inspector's initials + fiscal year + INC number, e.g., PLB910023. This INC number is the 23rd issued by inspector PLB in FY91.

Type the appropriate INC number in to the *UNIQUE INC NBR:* field.

Entering the Township

This is the Township of the well or facility where the violation was found. The township is found on the right center of the INC Form 3160-9.

Type the appropriate township in the *TWN:* field. Do not zero-fill the field.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

Entering the Line Identification Prefix

The Line Identification Prefix (IPRE) field is the first letter(s) in a data set that identifies an INC by line number. The Line ID Prefix, when combined with the Line ID Number field (INUM) and the Type field, makes up the data set. On October 1, 1990, the IPRE field was changed from a single-character field to a two-character field. Refer to the valid code list in Appendix A for valid codes prior to October 1, 1990. The old codes can be used for Tabletalk requests on older data.

The following codes are the new valid codes:

```
BO . . .  Blow Out prevention equipment inspection
C  . . .  Cementing well inspection
CS . . .  CaSing test inspection
CV . . .  gas Chart Verification
FI . . .  Follow-up Inspection (not related to INC)
DS . . .  Drill Stem test
HS . . .  Health & Safety Inspection
MC . . .  Meter (gas) Calibration
MP  . . . Meter (oil) Proving
O . . . . Other (Explain in Remarks)
PB  . . . Plug Back inspection
PC  . . . Prover/master meter Certification
PD  . . . Plugging of Depleted producer/service well
PN  . . . Plugging of a Noncompleted well
PR  . . . Production Records check
RD  . . . Royalty rate Determination
RR  . . . Record Review (after inspection re: pvi, etc.)
SA  . . . Surface inspection - Abandonment
SD  . . . Surface inspection - Drilling
SP  . . . Surface inspection - Production
SR  . . . Surface inspection - Restoration
SS  . . . Site Security inspection
T . . . . well Test inspection
TG  . . . Tank (oil) Gauging
TR  . . . TRansporter inspection
TV  . . . run Ticket Verification
WK  . . . WorKover
```

NOTE: The codes above are the same as the Inspection Activity Codes. The codes below are the same as the Inspection Type Codes.

```
DW  . . . Drilling Well inspection
ES  . . . Environmental/Surface inspection
ND  . . . Non-detailed Drilling inspection
NU  . . . Non-detailed Undesirable event
PD  . . . Plugging/abandonment well inspection (Downhole only)
PA  . . . Production Accountability inspection
PH  . . . Production Handling inspection
PV  . . . Production Verification inspection
RV  . . . Records (volume) Verification inspection
TH  . . . THeft inspection
NR  . . . Non-Routine environmental/surface inspection
WT  . . . Well Test inspection
```

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

The Line ID Prefix (INC Pre-Number) can be found at the bottom of the INC Form per WO IM 90-554.

The IPRE field is mandatory and edited in AIRS by comparing the code you have typed in against the date entered in the *IDENTIFY ID:* field.

Type the appropriate code in the *IPRE:* field.

Entering the Gravity of the Violation

The Gravity of the violation is entered as a numerical code in the gravity field. The gravity is found in the far right center portion of Form 3160-9.

The valid codes are:

1 = Major
2 = Moderate (old code, no longer used)
3 = Minor

Type the appropriate code in the *GRAVITY:* field.

Entering the Inspector's Name

The name of the inspector who issued the INC is entered in this field. The use of inspector's names or initials should be consistent through out the database. The Inspector's name is found on the far left center portion of Form 3160-9. This field is mandatory in AIRS.

Type the inspector's name in the *INSP:* field.

Entering the Range

This is the Range of the well or facility where the violation was found. The range is found in the center portion of Form 3160-9.

Type the appropriate Range in the RNG: field. Do not zero-fill the field.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

Entering the Line Identification Number

The Line ID Number (INUM) is the second part of the data set discussed previously that identifies an INC by line number. This field relates to the specific line item of the production and drilling inspection forms. This field is mandatory and edited in AIRS. AIRS edits only to ensure that a number between 1 and 83 is present.

The valid codes for **PRODUCTION INSPECTIONS** are:

NOTE: For Drilling codes see next page.

CODE	INCIDENT OF NONCOMPLIANCE
1	Site is not properly identified.
2	Well equipment is not satisfactory.
3	Environmental protection is not satisfactory.
4	Temporary or emergency pits are not approved.
5	Pits are not satisfactory.
6	Surface use is not in accordance with approval plan.
7	Monthly Report of Operations is not complete and current.
8	Monthly Report of Operations confirms the reasonableness of:
81	a. Production vs. sales.
82	b. Tank capacity vs. inventory.
83	c. Well status vs. actual status.
10	Off-lease measurement is not approved.
12	Other method of measuring oil and condensate is not approved.
13	Method of measuring oil and condensate is not satisfactory.
14	Valves are not sealed in accordance with minimum standards.
15	Site facility diagram is not satisfactory.
17	Off-lease storage of oil and condensate is not approved.
18	Liquid handling equipment is not satisfactory.
20	Commingling is not approved.
23	Flaring or venting or other is not approved.
24	Off-lease measurement is not approved.
27	Method of measurement (other than orifice meter) of natural gas is not approved.
28	Method of measuring natural gas is not satisfactory.
29	Natural gas handling/treating equipment is not satisfactory.
31	Collection of liquids is not satisfactory.
33	Water disposal method is not approved.
35	Disposal of water is not satisfactory.
37	Tank batteries are not properly equipped.
38	Warning signs are not properly installed.
39	If required, the contingency plan is not available.
40	Personnel are not properly protected.
41	Sales and management of oil and condensate are not documented according to minimum standards.
42	Operator has not established a site security plan in accordance with minimum standards.
43	Operator does not maintain a seal record.
44	Operator does not have a self-inspection program.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

50 . . . . Failed to comply with a notice, written order, or instruction of the authorized officer.
52 . . . . Prepared, maintained or submitted false, inaccurate or misleading reports, notices, affidavits, records, data, or other written information.
53 . . . . Failure to obtain approval for specific operations.

The valid codes for **DRILLING INSPECTIONS** are:

CODE	INCIDENT OF NONCOMPLIANCE

1 . . . . Approved drilling permit and plan are not on location.
2 . . . . Drill site is not properly identified.
3 . . . . Operations are not conducted in a workmanlike manner.
4 . . . . Operator failed to report spills.
5 . . . . Drill-stem test was not conducted according to minimum standards.
6 . . . . Hole deviation is not within approved tolerance.
7 . . . . Surface use is not in accordance with approved plan.
8 . . . . Well control and associated equipment is not installed, used, maintained, and tested to assure well control.
23 . . . Casing and cementing operations were not conducted according to approved plan.
28 . . . Mud system is not according to approved plan.
33 . . . Air and gas drilling operations are not according to approved plan or do not meet minimum standards.
37 . . . Hydrogen sulfide operations do not meet minimum standards or are not conducted according to approved plan.
50 . . . Failed to comply with a notice, written order, or instruction of the authorized officer.
52 . . . Prepared, maintained or submitted false, inaccurate or misleading reports, notices, affidavits, records, data, or other written information.

The valid codes for **ABANDONMENT INSPECTIONS** are:

CODE	INCIDENT OF NONCOMPLIANCE

1 . . . . Plugging/Abandonment operations are not conducted according to approved plan.
2 . . . . Rehabilitation does not meet approved plan.
50 . . . Failed to comply with a notice, written order, or instruction of the authorized officer.
52 . . . Prepared, maintained or submitted false, inaccurate or misleading reports, notices, affidavits, records, data, or other written information.

Type the appropriate code in the *INUM:* field.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

Entering the Assessment Schedule

This field identifies the schedule by which penalties are to be assessed. Information about this field can often be found in the remarks section on Form 3160-9.

The valid codes are:

S = Single Payment
P = Per Day
Blank = Not Applicable

Type the appropriate code in the *ASM SCH:* field.

Entering the Well Number

This field identifies the well number (left center portion of Form 3160-9) where the violation was found. The well number should be the same as used by the operator and be consistent with the well number in the well record in AIRS.

Type the well number in the *WELL:* field.

Entering the Section

This is the section number of the well or facility where the violation was found. The section is found in the right center portion of Form 3160-9.

Type the appropriate number in the *SEC:* field.

Entering the Type of INC

The type of INC is a one-character field that identifies the INC as being either administrative or operative. An administrative INC is generally a violation in which an operator has not filed required paperwork, or the paperwork has not been approved. An operative INC is a violation generally discovered during a field inspection involving actual field operations. The Type field is the last field of the line number data set.

The valid codes are:

O = Operative
A = Administrative
Blank = Determination needs to be made.

Type the appropriate code in the *TYPE:* field.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

Entering the Assessment Amount

This field identifies the assessment to be paid by the operator in whole dollars. The amount is listed on the center portion of the INC Form 3160-9.

Type the assessment amount in whole dollars in the *ASM AMT:* field.

NOTE: This field must be updated if changed by an appeal or some other factor.

Entering the Facility Identifier

The identifier of the facility where the violation was found is entered in this field. This entry should be consistent with the facility identifier used in the facility record.

Type the appropriate number in the *FAC:* field.

Entering the Quarter Section

The QTR field is used for the quarter/quarter section surface location of the well or facility where the violation was found. For metes-and-bounds descriptions, use a single zero in the field. For irregular sections, the use of lot or tract numbers, described as "L" or "T" plus the number is required for the QTR, if applicable. The 1/4 1/4 information is found in the center portion of Form 3160-9.

Type the appropriate code in the *QTR:* field. Do not zero-fill the field. (You can use a single zero for metes and bounds.)

Entering the Form of Notification to the Operator

The type of form used to take enforcement action on this violation is entered in this field. There are four forms of notification:

An **ORDER** is an order by the authorized officer to the operator. A written or oral order is used to supplement an existing approval or to specify requirements that are not covered by regulation or by an approval. The order is not an INC letter.

An **INC** is a notice of violation to the operator on the INC Form 3160-9 or in a letter containing a warning and appeal rights.

A **SHUT-DOWN LETTER** is an order on Form 3160-12 or in letter format from the authorized officer to the operator to shut-in operations.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

A VERBAL WARNING is an oral warning by the authorized officer to the operator to correct a violation. (See WO IM 90-554 for additional details.)

The valid codes are:

O = Order
I = INC
SL = Shut Down Letter
V = Verbal Warning (The phrase 'oral warning' must also be placed in remarks)

Type the appropriate code in the *FORM:* field.

Entering Penalty Amount

The amount of the civil penalty to be paid by the operator in whole dollars is entered in this field. The penalty amount may be listed on the bottom of the INC form.

Type the appropriate amount in the *PENALTY:* field.

Entering the Meridian

The meridian is the reference or survey from which the location information was determined. The meridian is given on the right center portion of Form 3160-9.

Type the appropriate code in the *MRDN:* field.

Entering the Attached Bond Action

Has the authorized officer taken action to attach the bond?

Valid codes are:

Y = Yes
N = No
Blank = Not Applicable

Type the appropriate code in the *ATCH BOND:* field.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

Entering the INC Identification Date

The date the violation was identified is entered in YYMMDD format. This date is the date given in the Date block (left center portion of Form 3160-9). This field is mandatory and edited in AIRS.

The *IDENTIFY DT:* field is used to determine allowable codes in the IPRE (Line Identification Prefix) field.

Type the identification date in the *IDENTFY DT:* field.

Entering the INC Correction Date

The date that the INC was corrected by the operator is entered in YYMMDD format. This date is often found on the white copy of the INC Form 3160-9 after it has been returned to BLM by the operator.

NOTE: The INC Correction Date is used for the INC Report of outstanding INCs (Menu Option 25). If a date is entered, the INC will not appear on the report because this date means the INC has been corrected.

Type the correction date in the *CORRCT DT:* field.

Entering the Termination of Lease Action

Has the authorized officer taken action to terminate the lease?

Valid codes are:

Y = Yes
N = No
Blank = Not Applicable

Type the appropriate code in the *TRM LEASE:* field.

Entering the Effective Date of the INC

The Effective Date is the date the INC was received by the operator or seven working days after the INC was mailed, whichever is earlier. Most INCs are mailed by Certified Mail-Return Receipt Requested. The date the operator received the INC may be documented on the receipt or on Form 3160-9 in the upper left-hand corner if hand-delivered. This date is often used as the basis to calculate the abatement date.

Type the appropriate date in the *EFFECT DT:* field.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

Entering the Appeal Date

The date the operator filed an appeal with the Interior Board of Land Appeals is entered in YYMMDD format.

Type the appropriate date in the *APPEAL DT:* field.

Entering the Shut-Down Action

Has the authorized officer ordered the operator to shut-down operations?

Valid codes are:

Y = Yes
N = No
Blank = Not Applicable

Type the appropriate code in the *SHUT DOWN:* field.

Entering the Abatement Date

The date the corrective action is to be completed is entered in YYMMDD format. This date may be given on Form 3160-9 as either a specific date or a time period. If a time period is given, such as 30 days, calculate the abatement date using the effective date as the starting date. The abatement date is used as a key field for generating the INC Report (Main Menu option #25). If you have a question about this date, ask the Inspector for assistance.

Type the appropriate date in the *ABATEMT DT:* field.

Entering the TPR (State Director's Review) Filing Date

The date that the operator filed a request for a State Director's Review, formerly called a TPR, is entered in YYMMDD format.

Type the appropriate date in the *TPR FL DT:* field.

Entering the Bureau of Indian Affairs Concurrence Date

This is the date that BIA concurred with the enforcement action and applies to Indian IIDs only. On some enforcement actions, such as shut in, termination of lease, and attachment of bond, BIA concurrence is required.

Type the appropriate date in the *BIA CNCUR:* field.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

Entering the Bureau of Indian Affairs Release Date

The date BIA agreed to release is entered in YYMMDD format. This applies to Indian Leases only.

Type the appropriate date in the *BIA REL DT:* field.

Entering the Follow-Up Date

This is the date when the inspector follows up to ensure that the violation has been actually corrected. If the inspector makes a trip to the field, this follow-up inspection is also counted in the FOL TRIPS field.

Type the appropriate date in the *FOLLOW DT:* field.

Entering the Extension Date

The authorized officer may on occasion extend the correction date for the violation or in effect change the abatement date. The authorized officer may further extend the abatement date several times. Up to three extensions can be tracked in AIRS by using the 1st, 2nd, and 3rd extension date fields. The INC Report uses the information in these fields to calculate when an INC is due or past due.

The first new abatement date is typed in the *1ST EXT DT:* field.

The second abatement date is typed in the *2ND EXT DT:* field.

The third abatement date is typed in the *3RD EXT DT:* field.

Entering the Number of Follow-Up Trips

The number of follow-up trips to the IID to ensure that the violation was corrected is tracked in this field.

Type the number of follow-up trips in the *FOL TRIPS:* field.

Entering Follow-Up Remarks

Enter any remarks--up to 40 characters--pertaining to follow-up actions on the INC.

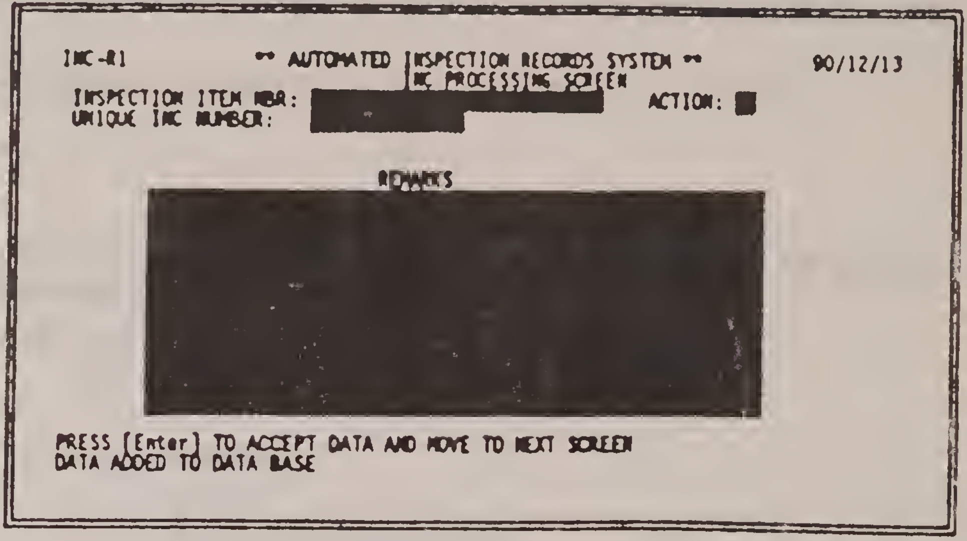
Additional remarks--up to 540 characters--can be made by accessing a remarks screen INC-12 as follows:

Enter a **Y** in the WANNA ADD REMARKS (Y/N) field and then press the **[ENTER]** key.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

The INC-R1 screen will appear.



```
INC-R1          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/12/13
                          INC PROCESSING SCREEN
 INSPECTION ITEM NBR:                                ACTION:
 UNIQUE INC NUMBER:

                          REMARKS




PRESS [Enter] TO ACCEPT DATA AND MOVE TO NEXT SCREEN
DATA ADDED TO DATA BASE
```

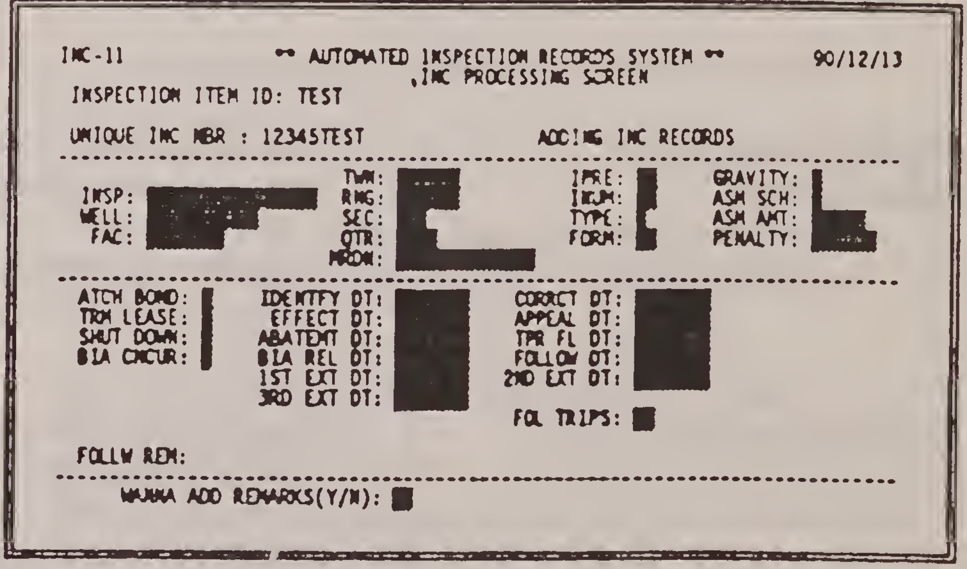
Remember to TAB between Remarks lines. Describe the nature of the violation clearly and in detail (WO IM 90-554).

NOTE: When you typed a **Y** and **[ENTER]** to access the INC-12 screen, the data on screen INC-11 was added to the database.

Entering the Data onto the Computer

Press the **[ENTER]** key to enter all data on the screen onto the data base itself.

If the data is accepted, the INC-11 screen is displayed:



```
INC-11          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/12/13
                         ,INC PROCESSING SCREEN
 INSPECTION ITEM ID: TEST

 UNIQUE INC NBR : 12345TEST                  ADDING INC RECORDS
-------------------------------------------------------------------------
                       TWN:                IPRE:          GRAVITY:
  INSP:                RNG:                INUM:          ASM SCH:
  WELL:                SEC:                TYPE:          ASM AMT:
   FAC:                QTR:                FORM:          PENALTY:
                      MRDN:
-------------------------------------------------------------------------
 ATCH BOND:      IDENTFY DT:          CORRCT DT:
 TRM LEASE:       EFFECT DT:          APPEAL DT:
 SHUT DOWN:      ABATEMT DT:          TPR FL DT:
 BIA CNCUR:      BIA REL DT:          FOLLOW DT:
                 1ST EXT DT:          2ND EXT DT:
                 3RD EXT DT:
                                      FOL TRIPS:
 FOLLW REM:
-------------------------------------------------------------------------
     WANNA ADD REMARKS(Y/N):
```

NOTE: The "Data added ..." message will not appear when you have selected the additional remarks screen. The data is saved when you exit screen INC-R1 by pressing **[ENTER]**.

3.7 Entering an INC

3.7.1 Adding a Non-Compliance Record

Entering Additional Non-Compliance Records

The INC-11 screen allows other INCs to be entered for the Inspection item displayed if desired.

Follow the steps previously given, beginning with the 'Entering the Unique INC Number' step.

Exiting the Adding INC Data Entry Screen

AIRS allows you to choose where you wish to exit to. You may exit back to the INC PROCESSING Menu screen or to the Main Menu.

If you wish to add, update, or browse INC Records:

Press the [F2] key. The INC PROCESSING (INC-00) screen should appear.

If you wish to return to the Main Menu:

Press the [F3] key. The AIRS Main Menu should appear.

Correcting Errors

Error messages will appear in red at the bottom of the screen anytime an incorrect entry is made in an *edited* field. Edited fields will display entered data using green characters; the cursor will also be green.

If you get an error message 'Invalid ID Prefix,' verify that the *IDENTIFY DT:* field contains a correct date. AIRS uses the date to determine which codes are allowable in the ID Prefix field.

Any error in an edited field must be corrected before the system will accept your data.

Errors made in unedited fields that are accepted by the computer may be corrected by using the Specific INC (S) option of the INC PROCESSING Screen. Updating the INC record is covered in Updating a Non-Compliance Record, Section 3.7.2 of this Handbook.

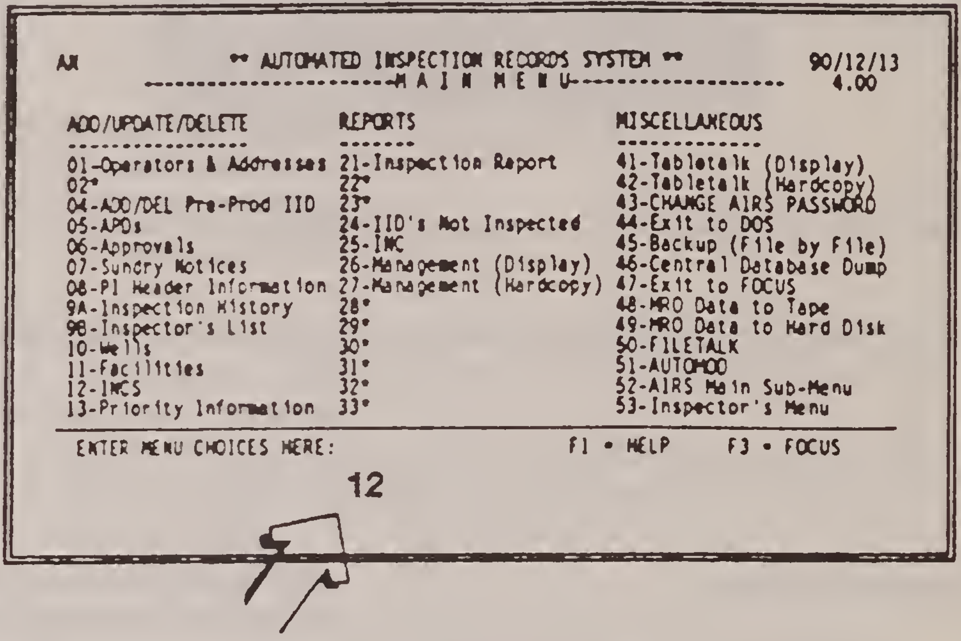
3.7 Entering an INC

3.7.2 Updating a Non-Compliance Record

Updating a Non-Compliance Record (INC) (Introduction)

Once you have selected the INC record you wish to update, the steps for updating an INC record are the same as they are for entering a INC record. This section therefore emphasizes the steps involved in selecting the INC record. Refer to Section 3.8.1 if you have specific questions about updating a particular field.

From the Main Menu:



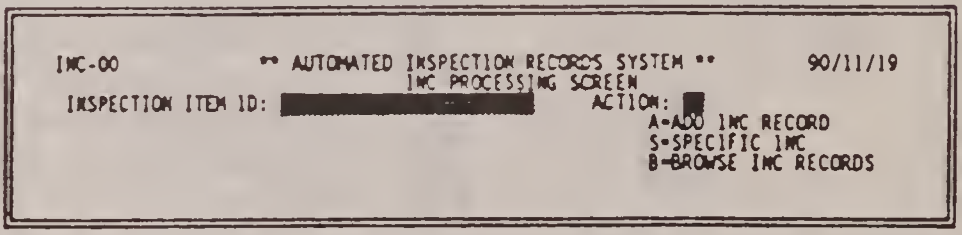
```
AM            ** AUTOMATED INSPECTION RECORDS SYSTEM **            90/12/13
        -----------------------M A I N  M E N U-------------------   4.00

ADD/UPDATE/DELETE          REPORTS                    MISCELLANEOUS
-----------------          -------                    -------------
01-Operators & Addresses   21-Inspection Report       41-Tabletalk (Display)
02*                        22*                        42-Tabletalk (Hardcopy)
04-ADD/DEL Pre-Prod IID    23*                        43-CHANGE AIRS PASSWORD
05-APDs                    24-IID's Not Inspected     44-Exit to DOS
06-Approvals               25-INC                     45-Backup (File by File)
07-Sundry Notices          26-Management (Display)    46-Central Database Dump
08-PI Header Information   27-Management (Hardcopy)   47-Exit to FOCUS
9A-Inspection History      28*                        48-MRO Data to Tape
9B-Inspector's List        29*                        49-MRO Data to Hard Disk
10-Wells                   30*                        50-FILETALK
11-Facilities              31*                        51-AUTOMOD
12-INCS                    32*                        52-AIRS Main Sub-Menu
13-Priority Information    33*                        53-Inspector's Menu
-------------------------------------------------------------------------------
ENTER MENU CHOICES HERE:                        F1 = HELP      F3 = FOCUS
```

12

Type **12** in the area *ENTER MENU CHOICES HERE:* at the bottom of the Main Menu screen.

Press the [**ENTER**] key.

The following screen (INC-00) is displayed:



```
INC-00         ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/11/19
                              INC PROCESSING SCREEN
 INSPECTION ITEM ID:                              ACTION:
                                                      A=ADD INC RECORD
                                                      S=SPECIFIC INC
                                                      B=BROWSE INC RECORDS
```

Entering an Inspection Item ID (IID) and Action Code

From the INC Processing Screen (INC-00) you are asked to input (1) the Inspection Item ID for which you wish to add the Non-Compliance Record and (2) an Action code. The IID is found on the upper right of Form 3160-9.

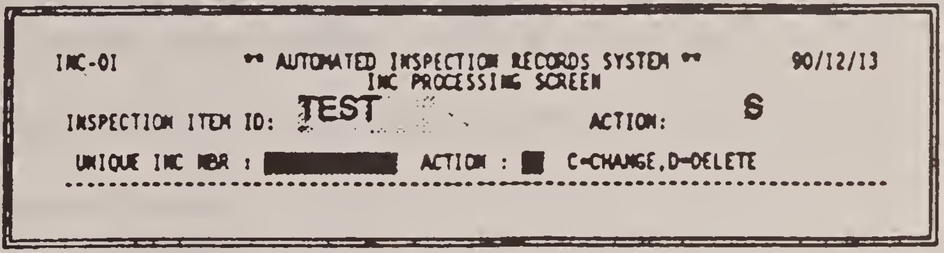
3.7 Entering an INC

3.7.2 Updating a Non-Compliance Record

Type the Inspection Item ID you wish to add the Non-Compliance record for in the *INSPECTION ITEM ID:* field.

Press the [TAB] key and type **S** in the *ACTION:* field.

Press the **[ENTER]** key.The following screen (INC-01) is displayed:



```
INC-01          ** AUTOMATED INSPECTION RECORDS SYSTEM **        90/12/13
                          INC PROCESSING SCREEN
INSPECTION ITEM ID:  TEST                        ACTION:     S
 UNIQUE INC NBR :            ACTION :     C-CHANGE,D-DELETE
-------------------------------------------------------------------------
```

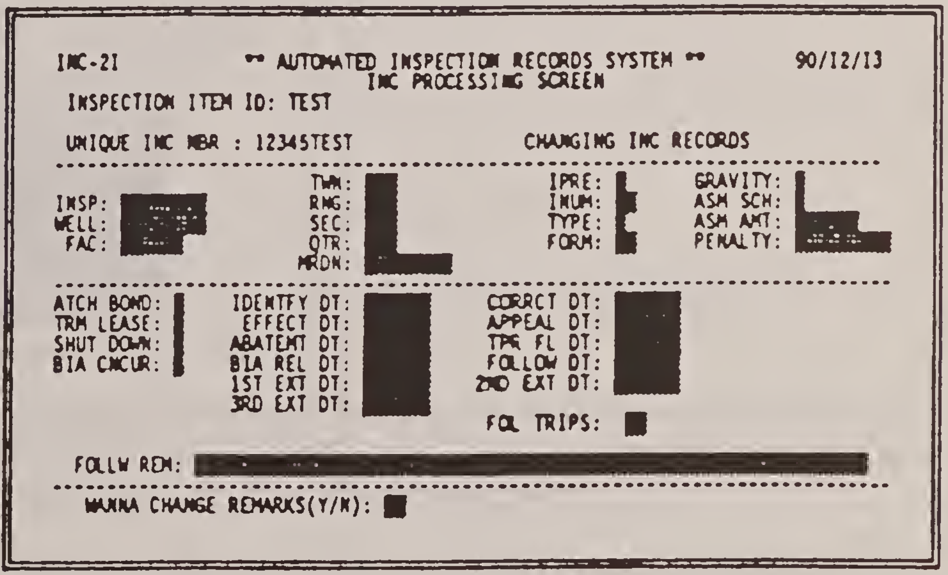
Entering the Unique INC Number

The Unique INC Number (up to 10 characters) of the Notice of Incidents of Noncompliance you wish to update is input into the UNIQUE INC NBR data field. The Unique INC Number may be found on the upper right of Form 3160-9.

Type the appropriate INC number in to the *UNIQUE INC NBR:* field.

Type **C** in the *ACTION:* field.

The INC PROCESSING screen (INC-21) will appear with the data displayed for the INC you wish to update.



```
INC-21          ** AUTOMATED INSPECTION RECORDS SYSTEM **        90/12/13
                          INC PROCESSING SCREEN
 INSPECTION ITEM ID: TEST

 UNIQUE INC NBR : 12345TEST                  CHANGING INC RECORDS
-------------------------------------------------------------------------
                     TWN:               IPRE:        GRAVITY:
 INSP:               RNG:               INUM:        ASM SCH:
 WELL:               SEC:               TYPE:        ASM AMT:
  FAC:               QTR:               FORM:        PENALTY:
                    MRDN:
-------------------------------------------------------------------------
ATCH BOND:     IDENTFY DT:          CORRCT DT:
TRM LEASE:      EFFECT DT:          APPEAL DT:
SHUT DOWN:     ABATEMT DT:          TPS FL DT:
BIA CNCUR:      BIA REL DT:          FOLLOW DT:
                1ST EXT DT:         2ND EXT DT:
                3RD EXT DT:
                                    FOL TRIPS:

  FOLLW REM:
-------------------------------------------------------------------------
   WANNA CHANGE REMARKS(Y/N):
```

3.7 Entering an INC

3.7.2 Updating a Non-Compliance Record

Updating the INC Record Data Fields

From the Changing INC Records Screen (INC-21), you are able to update any field and make remarks. To update a particular field, use the [TAB] key or the arrow keys to move the cursor to the data field that you wish to update. Type in the change and repeat the process for any other data fields you wish to update.

After you have made any desired changes to the data fields, you may then make additional remarks.

If you do not wish to make additional remarks:

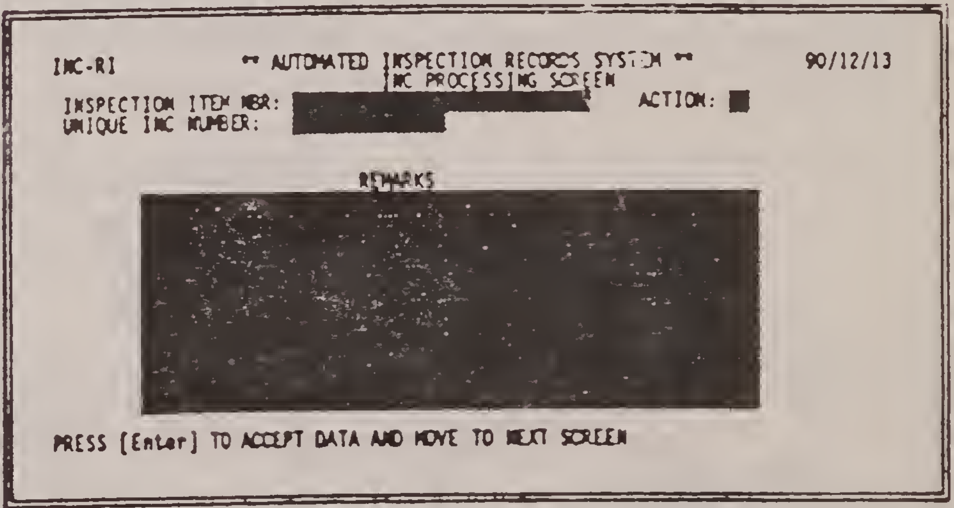
Skip to the next step, 'Entering the Data onto the Computer.'

If you wish to make additional remarks:

Type a **Y** in the *WANNA CHANGE REMARKS (Y/N):* field at the bottom of the screen. Then press the **[ENTER]** key.

NOTE: The changes you made on INC-21 screen will be added to the database when you press the **[ENTER]** key.

The following screen (INC-R1) will appear:



```
INC-RI            ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/12/13
                             INC PROCESSING SCREEN
 INSPECTION ITEM NBR:                                    ACTION:
 UNIQUE INC NUMBER:

                         REMARKS

PRESS [Enter] TO ACCEPT DATA AND MOVE TO NEXT SCREEN
```

Type the appropriate remarks in the space provided. Remember to use the [TAB] key to move between lines.

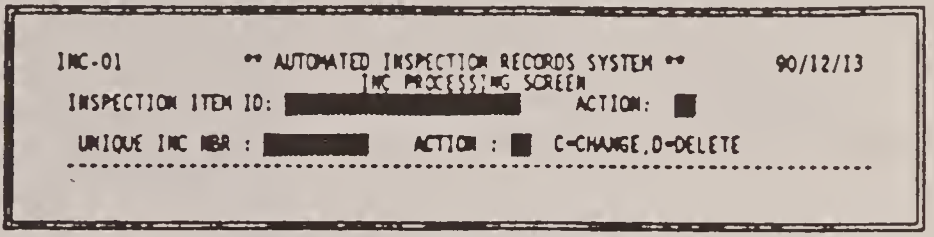
3.7 Entering an INC

3.7.2 Updating a Non-Compliance Record

Entering the Data onto the Computer

Press the **[ENTER]** key to enter all data on the screen onto the data base itself.

If the data is accepted, the INC-01 screen is displayed:



```
INC-01          ** AUTOMATED INSPECTION RECORDS SYSTEM **         90/12/13
                           INC PROCESSING SCREEN
 INSPECTION ITEM ID: ████████████████         ACTION: █
  UNIQUE INC NBR : ████████     ACTION : █  C-CHANGE,D-DELETE
 --------------------------------------------------------------------------
```

Updating Additional Non-Compliance Records

The INC-01 screen allows other INCs to be updated for the Inspection Item displayed if desired.

Follow the steps previously given, beginning with the "Entering the Unique INC Number" step.

Exiting the Adding INC Data Entry Screen

AIRS allows you to choose where you wish to exit to. You may exit back to the INC PROCESSING Menu screen or to the Main Menu.

If you wish to add, update, or browse INC Records:

Press the **[F2]** key. The INC PROCESSING (INC-00) screen will appear.

If you wish to return to the Main Menu:

Press the **[F3]** key. The AIRS Main Menu will appear.

Correcting Errors

Error messages will appear anytime an incorrect entry is made in an *edited* field. Edited fields will display entered data using green characters; the cursor will also be green.

Any error in an edited field must be corrected before the system will accept your data. The error messages appear in red at the bottom of the data entry screen.

3.8 Creating and Printing Reports 3.8.0 Overview

Overview

This section describes how to create and print out several pre-programmed reports. These "canned" reports provide a means to obtain AIRS data in a standardized format for areas of special interest. It was never intended that these reports meet all requirements for data from the system. The requirements for reports are so varied that it would be impractical to hard code all of the various reports that a user might need. Therefore, system users are expected to build their own custom reports. (Refer to Tabletalk, Chapter 5 of this Handbook.) Note that Quality Control Reports can be created using Main Menu Option 52 (see Section 7.2).

There are four canned reports: (1) the Inspection Report, (2) the IIDs Not Inspected Report, (3) the INC Report, and (4) the Management Report.

> The **INSPECTION REPORT** is a series of eight separate reports about the various record types in AIRS designed to display information to users and serve as a standardized input form, when annotated by the Inspector, for transmitting changes back to the data entry person.
>
> The **IIDS NOT INSPECTED REPORT** is designed to identify IIDs that have not been inspected during a specified time frame, e.g., the last three years.
>
> The **INC REPORT** identifies all Incidents of Non-Compliance (INCs) that have not been corrected by the operator and sorts the INCs identified by how late they are, e.g., due now, and 30, 60, 90 or more days late.
>
> The **MANAGEMENT REPORT** is a series of reports designed to provide management with general statistics about the AIRS data base.

The above reports are based on a current understanding of users' requirements. It is anticipated that these requirements may change over time or that reports may need to be modified. Contact your AIRS User Group representative with any suggested changes or additions.

Sample Reports

Sample reports are provided at the end of each subsection. Notes have been added to help you understand the features of these reports.

3.8 Creating and Printing Reports

3.8.1 Inspection Report

Creating an Inspection Report (Introduction)

This section describes how to print out the Inspection Report. This Report is a series of eight separate reports about the various record types in AIRS. The report begins by printing out the Header Record, followed in order by the Inspector's list, a blank Inspection History form, the Inspection History, the well/completion record(s), the facility record(s), the approval records, the Inspection Priority(s), and, finally, any outstanding Incidents of Non-compliance.

This report is designed to be printed on either wide paper or on 8 1/2" by 11" paper using a local-printer-controlled compressed (17 cpi) print font. There are three options you can choose from to select the Inspection Report(s) you wish to print out.

Option 1	All inspections for a specific IID.
Option 2	All inspections for a specific priority year(s) for a specific IID.
Option 3	All inspections for ALL IIDs in any given township, range, and/or overall priority.

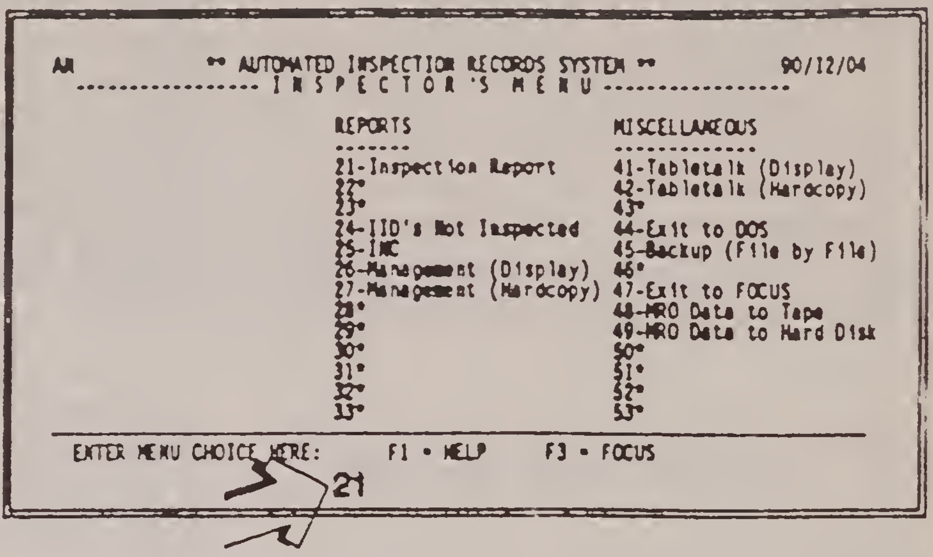
All options print out the same basic information except for the Inspection History. Note that option 3, depending on the nature of the request, will print out numerous IIDs and all of their inspection history and may take several hours to complete. On the other hand, Option 1 will print out only the inspection history for a single IID. Option 2 is designed to further limit the amount of inspection history information printed out, based on your selection of one or two priority year's worth of information.

The Report can be printed out from either the Main Menu or the Inspector's Menu. The procedures are identical.

3.8 Creating and Printing Reports

3.8.1 Inspection Report

From the Inspector's (or Main Menu) Menu:

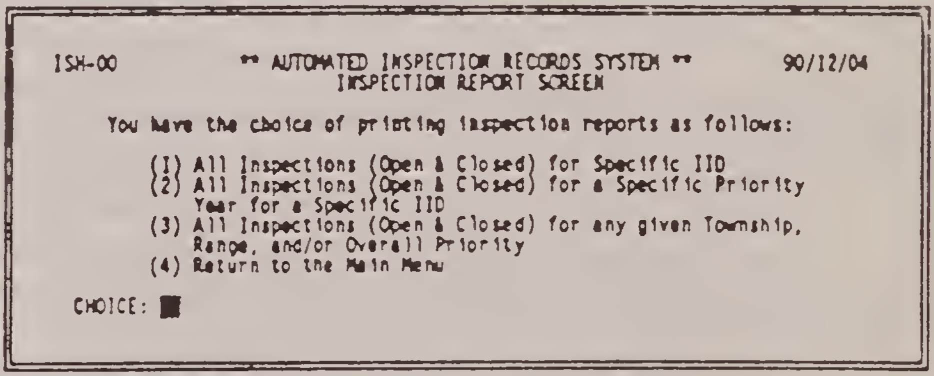


```
AM            ** AUTOMATED INSPECTION RECORDS SYSTEM **            90/12/04
----------------- I N S P E C T O R ' S   M E N U -----------------

                         REPORTS                     MISCELLANEOUS
                         -------                     -------------
                         21-Inspection Report        41-Tabletalk (Display)
                         22*                         42-Tabletalk (Hardcopy)
                         23*                         43*
                         24-IID's Not Inspected      44-Exit to DOS
                         25-INC                      45-Backup (File by File)
                         26-Management (Display)     46*
                         27-Management (Hardcopy)    47-Exit to FOCUS
                         28*                         48-MRO Data to Tape
                         29*                         49-MRO Data to Hard Disk
                         30*                         50*
                         31*                         51*
                         32*                         52*
                         33*                         53*
ENTER MENU CHOICE HERE:      F1 = HELP      F3 = FOCUS
                         21
```

Type **21** in the area *ENTER MENU CHOICE HERE:* at the bottom of the Inspector's Menu (or Main Menu) Screen.

Press the [ENTER] key.

The ISH-00 screen is displayed:



```
ISH-00         ** AUTOMATED INSPECTION RECORDS SYSTEM **         90/12/04
                       INSPECTION REPORT SCREEN

    You have the choice of printing inspection reports as follows:

       (1) All Inspections (Open & Closed) for Specific IID
       (2) All Inspections (Open & Closed) for a Specific Priority
           Year for a Specific IID
       (3) All Inspections (Open & Closed) for any given Township,
           Range, and/or Overall Priority
       (4) Return to the Main Menu

 CHOICE: █
```

Choosing the Printing Option

From the Inspection Report Screen (ISH-00) you are asked to choose which option you wish the Inspection Reports to be selected by.

Choose **1**	If you wish the entire Inspection History for a specific Inspection Item.
Choose **2**	If you wish the Inspection History for only one or two priority years for a specific Inspection Item.

3.8 Creating and Printing Reports

3.8.1 Inspection Report

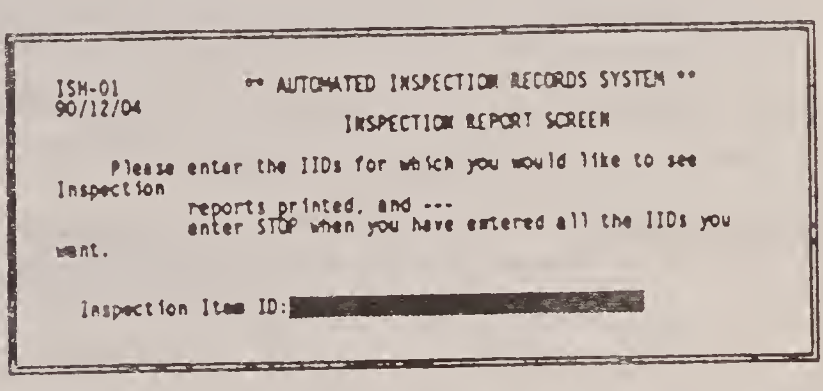
Choose **3**	If you wish the entire Inspection History for all Inspection Items within a township, range, and/or overall priority.
Choose **4**	If you wish to return to Menu Screen. (You may also press the F3 key to return to Menu Screen.)

Type your selection in the *CHOICE:* field and press the [ENTER] key.

NOTE: Please move ahead in this section to the choice (Option 1, 2, or 3) you have selected.

Option 1:
Printing All Inspections for a Specific IID

To print <u>all</u> Inspection Histories for a specific IID, select Option 1 from screen ISH-00, and the following screen (ISH-01) will be displayed:



```
ISH-01             ** AUTOMATED INSPECTION RECORDS SYSTEM **
90/12/04
                          INSPECTION REPORT SCREEN

      Please enter the IIDs for which you would like to see
Inspection
            reports printed, and ---
            enter STOP when you have entered all the IIDs you
want.

   Inspection Item ID:
```

Entering the IID

Type the IID(s) you wish to have an Inspection Report(s) printed out for in the *Inspection Item ID:* field.

Press the [ENTER] key.

A green colored message will appear at the bottom of the screen which indicates that an inspection report will be printed for the IID you selected.

Entering Additional IIDs

If you wish to printout additional Inspection reports:

Repeat the step above for entering an IID.

Printing the Inspection Report

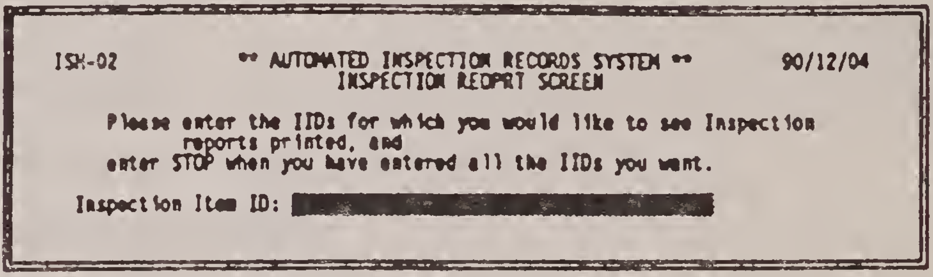
If you wish to STOP entering IIDs and print out the Inspection Reports you have selected:

Type **STOP** in the *Inspection Item ID:* field and press the [ENTER] key. The reports will be generated and printed out. Be sure your printer is online.

NOTE: If you wish to escape and not print any reports, press the [F3] key to return to the Menu Screen.

Option 2:
Printing All Inspections for a Specific Priority Year for a Specific IID

To print out Inspection Histories for specific priority years, select Option 2 from screen ISH-00 and the following screen (ISH-02) will now be displayed:



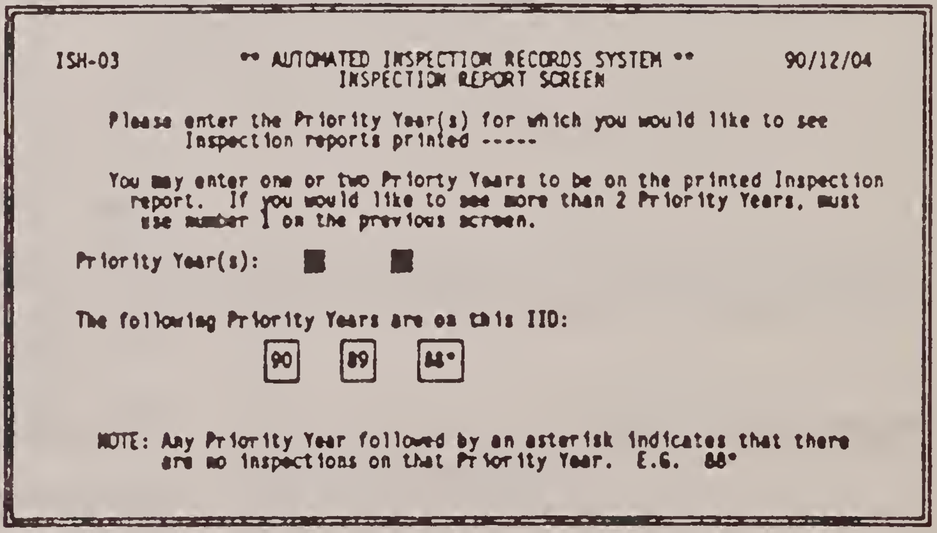
```
ISH-02          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/12/04
                          INSPECTION REDPRT SCREEN

        Please enter the IIDs for which you would like to see Inspection
              reports printed, and
        enter STOP when you have entered all the IIDs you want.

     Inspection Item ID:
```

Entering the IID

Type the IID you wish to have an Inspection Report printed out for in the *Inspection Item ID:* field.

Press the [ENTER] key.

The following screen (ISH-03) is displayed:



```
ISH-03          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/12/04
                          INSPECTION REPORT SCREEN

         Please enter the Priority Year(s) for which you would like to see
              Inspection reports printed -----

         You may enter one or two Priorty Years to be on the printed Inspection
           report.  If you would like to see more than 2 Priority Years, must
            use number 1 on the previous screen.

      Priority Year(s):

      The following Priority Years are on this IID:

                    90    89    88*

        NOTE: Any Priority Year followed by an asterisk indicates that there
              are no inspections on that Priority Year.  E.G.  88*
```

3.8 Creating and Printing Reports

3.8.1 Inspection Report

Entering the Priority Year(s)

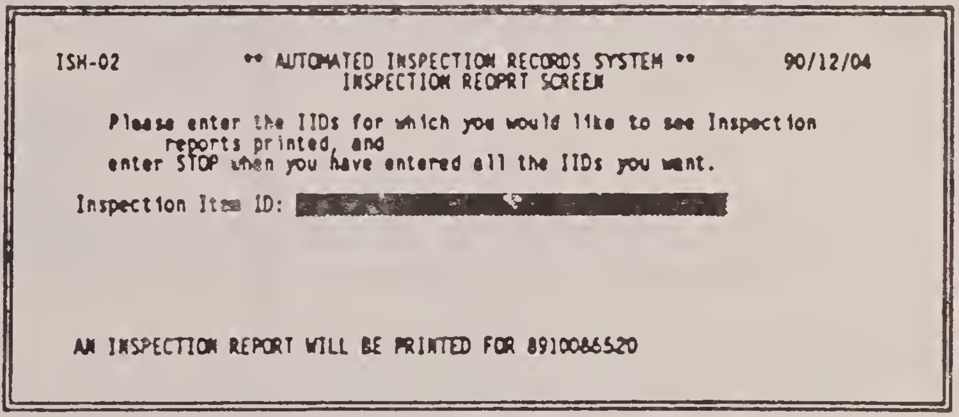
You may enter one or two Priority Years of Inspection History to be printed on the Inspection report. If you want more than two years of inspection history, you must use Option 1. A listing of all of the years for which there is a Priority Record for the IID you selected is presented on screen. Any Priority Record for which there are no inspections will have an asterisk beside the year, e.g., 88*.

If you select a priority year without inspections (e.g., 88*), an Inspection Sheet will be printed out without any Inspection History.

From the on-screen list of Priority Years, select the Priority Years you wish to have Inspection History information for and type the years in the *Priority Year(s):* fields.

Press the [ENTER] key.

The following screen (ISH-02) will appear with a green colored message that an Inspection report will be printed for the IID you selected at the bottom of the screen.



```
ISH-02            ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/12/04
                          INSPECTION REOPRT SCREEN

      Please enter the IIDs for which you would like to see Inspection
           reports printed, and
      enter STOP when you have entered all the IIDs you want.

   Inspection Item ID: [redacted]



   AN INSPECTION REPORT WILL BE PRINTED FOR 8910086520
```

Entering Additional IIDs

From screen (ISH-02) you may select additional IIDs for which you wish Inspection Reports.

If you wish additional Inspection reports:

Repeat the steps for Option 2 above for entering an IID.

Printing the Inspection Report

If you wish to STOP entering IIDs and print out the Inspection Reports you have selected:

Type **STOP** in the *Inspection Item ID:* field and press the [ENTER] key. The reports will be generated and printed out. Check that your printer is online.

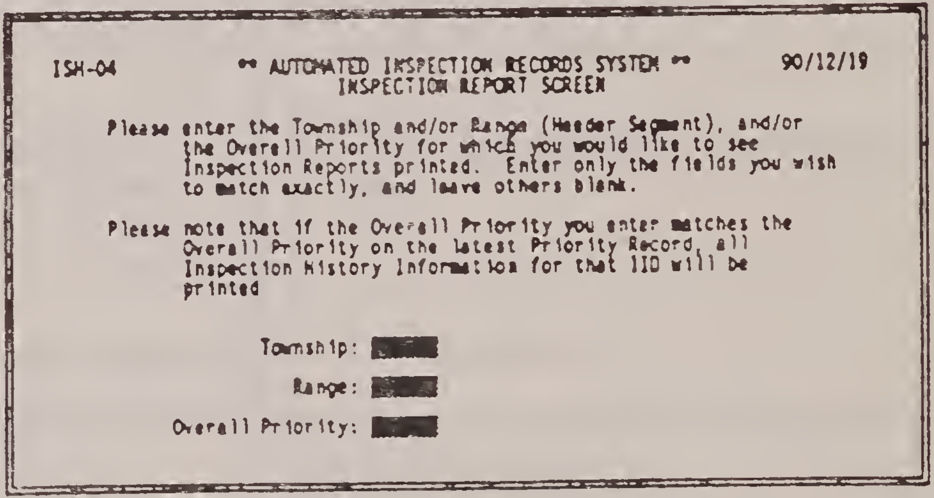
NOTE: If you wish to escape and not print any reports, press the [F3] key to return to the Menu Screen.

Option 3:

Printing All Inspection for any given Township, Range, and/or Priority Year

When you choose Option 3, you may specify a number of Inspection Reports based on geographic location, e.g., township and/or range, and/or overall inspection priority. Selection of Option 3 amounts to a global request. Depending on your request, the printing out process may take several hours.

Select Option 3 from screen ISH-00 and the following screen (ISH-04) will be displayed:



```
ISH-04          ** AUTOMATED INSPECTION RECORDS SYSTEM **          90/12/19
                         INSPECTION REPORT SCREEN

     Please enter the Township and/or Range (Header Segment), and/or
            the Overall Priority for which you would like to see
            Inspection Reports printed.  Enter only the fields you wish
            to match exactly, and leave others blank.

     Please note that if the Overall Priority you enter matches the
            Overall Priority on the latest Priority Record, all
            Inspection History Information for that IID will be
            printed

                          Township:
                             Range:
                  Overall Priority:
```

Entering the Township, Range, and/or Overall Priority

Type in the township and/or range (from the Header Record) and/or overall priority for which you would like Inspection Reports printed. Type in only the field you wish to match exactly, leaving the others blank. For example, if you want all of the IIDs in one township, such as 36N, enter 36N in the Township field and leave all other fields blank. On the other hand, if you want only the IIDs in Township 36N and Range 71W, enter 36N in the Township field and 71W in the Range field, leaving the overall priority field blank.

3.8 Creating and Printing Reports

3.8.1 Inspection Report

If the overall priority you select matches the latest priority for an IID on the system, ALL of the Inspection History Information for that IID wil be printed out.

Consider the following:

IID	Priority Records on System	Overall Priority
A	FY87	L
A	FY88	H
B	FY90	Z
B	FY89	H
B	FY88	H
C	FY91	X

You select Overall priority "H." The system will print out all of the Inspection History for IID A. On the other hand, IID B and C will not be printed because the latest priority record on the system is a "Z" or "X."

Entering Additional Requests

Because Option 3 is a global data request, there is no AIRS capability to enter additional requests without going back to the Main Menu or the Inspector's Menu.

Printing the Inspection Report

Press the [ENTER] key to run the report you have requested. Ensure that your printer is online.

NOTE: If you wish to escape from this option and not print any Inspection reports, press the [F3] key to return to Menu screen. If you wish to kill a report in progress, try pressing the [CTRL] + [BREAK] keys. If you get a message, "Focus interrupted," enter a KX. If all else fails, turn off the computer and printer.

Inspection Report Sample

```
       U.S. DEPARTMENT OF THE INTERIOR                    BUREAU OF LAND MANAGEMENT      PRINTED: 11/29/90
```

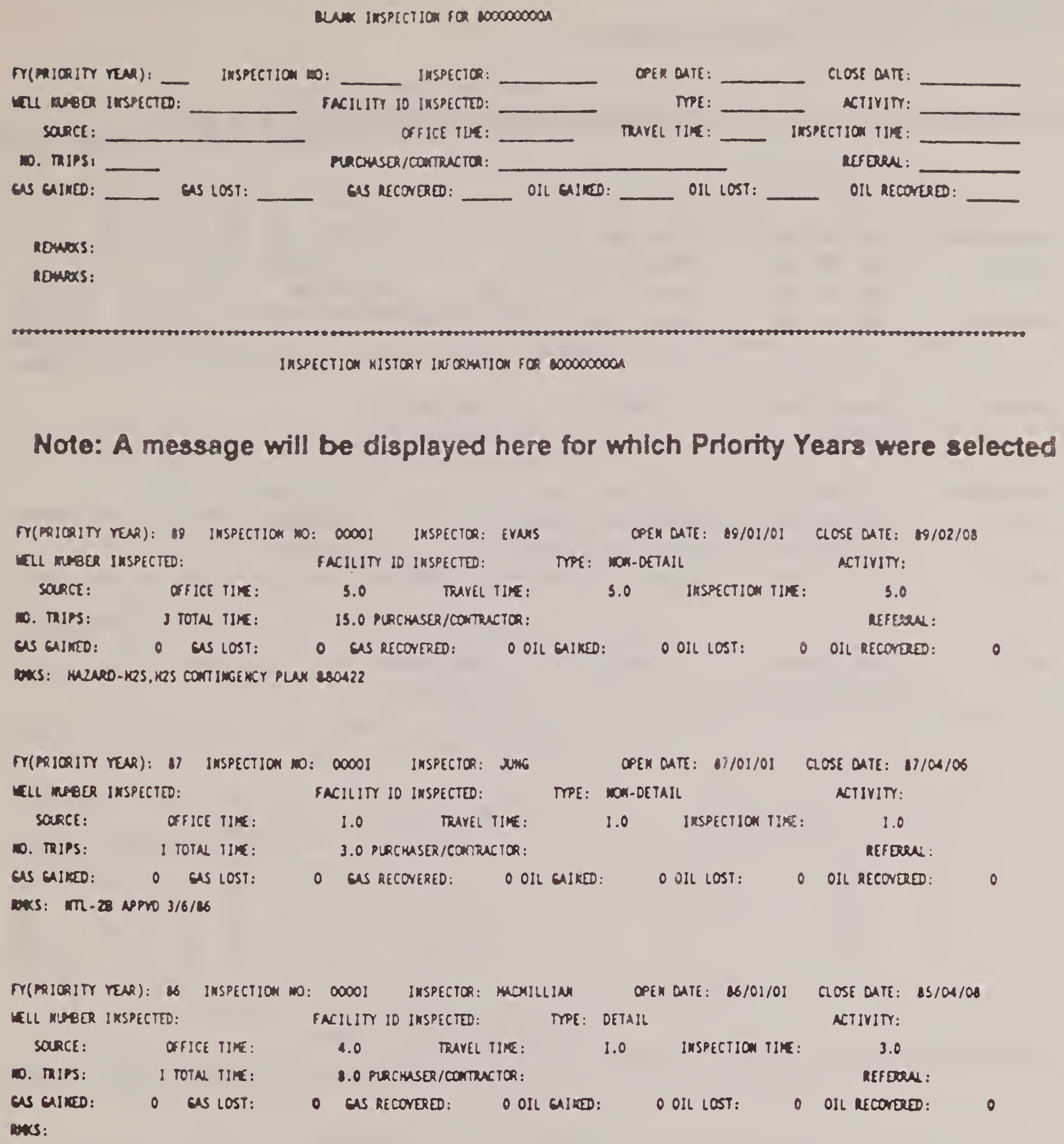
Note: This is the Header Record

```
     RESOURCE AREA: 064                          TWN: 40N           RANGE: 79W          SEC: 26
             CLASS: SECONDARY RECVRY UNT    MERIDIAN: 6TH             QTR:               LAT:
INSPECTION ITEM ID: 800000000A                COUNTY: NATRONA       STATE: WY           LONG:
        LEASE NAME: SALT CREEK APACHE UNIT  INDIAN AGCY:        LEASE STAT: E         HAZARD: Y
          OPERATOR: EVANS                   MINERAL OWN: 100     STAT DATE:          ROYALTY: VARIABLE
     CONTRACT: COC1000003

*********************************************************************************************************
                                            INSPECTOR'S LIST FOR 800000000A
```

NOTE: This is the Inspector's List

```
                                                     SATISFACTORY   DATE INSPECTED (YY/MM/DD)
   A. GENERAL

      __4. TEMPORARY OR EMERGENCY PITS APPROVED _________________     ------------------------------
                                                                      |                            |
   B. LIQUID HYDROCARBON PRODUCTION                                   | Codes to be used under the |
      __9. MEASUREMENT DONE ON LEASE, OFF LEASE, OR BOTH _________    | SATISFACTORY heading:      |
      __10. OFF LEASE MEASUREMENT APPROVED? ______________________    |                            |
      __11. METHOD OF MEASUREMENT:LACT METER _____________________    | Y - Satisfactory           |
      __                          TANK GAUGE _____________________    | N - Not Satisfactory       |
      __                          OTHER (SPECIFIY AS B11 IN REMARKS) __ | A - Not Applicable       |
      __12. OTHER METHOD OF MEASUREMENT APPROVED _________________    |                            |
      __16. IS PRODUCTION STORED ON LEASE, OFF LEASE OR BOTH _____    | O - On Lease               |
                                                                      | F - Off Lease              |
      __17. OFF LEASE STORAGE APPROVED ___________________________    | B - Both (On/Off Lease)    |
                                                                      ------------------------------
   C. OIL, CONDENSATE, NATURAL GAS PRODUCTION
      __19. COMMINGLING DONE ON LEASE, OFF LEASE OR BOTH _________
      __20. COMMINGLING APPROVED _________________________________

    D. NATURAL GAS PRODUCTION
      __22. GAS DISPOSITION BY SALES _____________________________
      __                       USE ON SITE _______________________
      __                       FLARING/VENTING ___________________
      __                       OTHER (SPECIFY AS D22 IN REMARKS) _____
      __23. FLARING/VENTING OR OTHER APPROVED ____________________
      __24. GAS MEASURED ON LEASE, OFF LEASE, OR BOTH ____________
      __25. OFF LEASE MEASUREMENT APPROVED _______________________
      __26. METHOD OF MEASUREMENT ORIFICE ________________________
      __                          TURBINE METER __________________
      __                          ESTIMATION _____________________
      __                          OTHER (SPECIFY AS D26 IN REMARKS) ___
      __27. METHOD OF MEASUREMENT APPROVED _______________________

   E. WATER DISPOSAL
      __33. DISPOSAL METHOD APPROVED _____________________________
      __34. WATER DISPOSAL BY UNLINED PITS _______________________
      __                      LINED PITS _________________________
      __                      SUBSURFACE _________________________
      __                      OTHER (SPECIFY AS E34 IN REMARKS) ______

   F. HYDROGEN SULFIDE OPERATIONS
        36. GAS STREAM  PPM        STV  PPM

RMKS:
```

Inspection Report Sample



```
                    BLANK INSPECTION FOR 800000000A

FY(PRIORITY YEAR): ___   INSPECTION NO: ______   INSPECTOR: __________     OPEN DATE: ________   CLOSE DATE: __________
WELL NUMBER INSPECTED: __________   FACILITY ID INSPECTED: __________           TYPE: ________     ACTIVITY: __________
   SOURCE: ___________________               OFFICE TIME: _______     TRAVEL TIME: ____   INSPECTION TIME: __________
 NO. TRIPS: _____                   PURCHASER/CONTRACTOR: ______________________                   REFERRAL: __________
GAS GAINED: _____   GAS LOST: _____   GAS RECOVERED: _____   OIL GAINED: _____   OIL LOST: _____   OIL RECOVERED: _____

  REMARKS:
  REMARKS:

*************************************************************************************************************************

                    INSPECTION HISTORY INFORMATION FOR 800000000A
```

Note: A message will be displayed here for which Priority Years were selected

```
FY(PRIORITY YEAR):  89   INSPECTION NO:  00001    INSPECTOR:  EVANS          OPEN DATE:  89/01/01   CLOSE DATE:  89/02/08
WELL NUMBER INSPECTED:                   FACILITY ID INSPECTED:        TYPE:  NON-DETAIL                 ACTIVITY:
   SOURCE:          OFFICE TIME:           5.0          TRAVEL TIME:          5.0       INSPECTION TIME:          5.0
NO. TRIPS:            3 TOTAL TIME:          15.0 PURCHASER/CONTRACTOR:                                   REFERRAL:
GAS GAINED:        0    GAS LOST:        0   GAS RECOVERED:        0 OIL GAINED:        0 OIL LOST:        0   OIL RECOVERED:        0
RMKS:  HAZARD-H2S,H2S CONTINGENCY PLAN 880422


FY(PRIORITY YEAR):  87   INSPECTION NO:  00001    INSPECTOR:  JUNG           OPEN DATE:  87/01/01   CLOSE DATE:  87/04/06
WELL NUMBER INSPECTED:                   FACILITY ID INSPECTED:        TYPE:  NON-DETAIL                 ACTIVITY:
   SOURCE:          OFFICE TIME:           1.0          TRAVEL TIME:          1.0       INSPECTION TIME:          1.0
NO. TRIPS:            1 TOTAL TIME:           3.0 PURCHASER/CONTRACTOR:                                   REFERRAL:
GAS GAINED:        0    GAS LOST:        0   GAS RECOVERED:        0 OIL GAINED:        0 OIL LOST:        0   OIL RECOVERED:        0
RMKS:  NTL-2B APPVD 3/6/86


FY(PRIORITY YEAR):  86   INSPECTION NO:  00001    INSPECTOR:  MACMILLIAN     OPEN DATE:  86/01/01   CLOSE DATE:  85/04/08
WELL NUMBER INSPECTED:                   FACILITY ID INSPECTED:        TYPE:  DETAIL                     ACTIVITY:
   SOURCE:          OFFICE TIME:           4.0          TRAVEL TIME:          1.0       INSPECTION TIME:          3.0
NO. TRIPS:            1 TOTAL TIME:           8.0 PURCHASER/CONTRACTOR:                                   REFERRAL:
GAS GAINED:        0    GAS LOST:        0   GAS RECOVERED:        0 OIL GAINED:        0 OIL LOST:        0   OIL RECOVERED:        0
RMKS:
```

```
                         WELL/COMPLETION RECORD(S) FOR B000000000A
```

Note: The "32" in the line below is the Unique Well Number in AIRS for this well.

```
   32  API NO.:  490250999900S1     QTR:  NWSW  OIL:  A     STATUS:  POW      BHL:                     CMZ:        MOC:  SI
       WEL NO.:  08TPSW26           SEC:   26   GAS:        P ZONE:  1TN   TRCT NO:                     FP:  SALT CREEK
       WEL NAM:                     TWN:  40N   H2O:  A     P METH:  ESS      SMA:  BLM                CTY:  NATRONA
       LS CA N:  WYC000000A         RNG:  79W   CO2:        D METH:  N  LEASE TYPE:  P          WELL TYPE:
 RMKS:
 RMKS:
 INSPECTION DATE:  89/02/08         2ND INSPECTION DATE:              SPUD DATE:          COMPLETION DATE:
   PLUGGING DATE:                 SITE RESTORATION DATE:                              STATUS CHANGE DATE:

   31  API NO.:  490250888800SI     QTR:  NWSE  OIL:  A     STATUS:  POW      BHL:                     CMZ:        MOC:  SI
       WEL NO.:  08TPSE26           SEC:   26   GAS:        P ZONE:  1TN   TRCT NO:                     FP:  SALT CREEK
       WEL NAM:                     TWN:  40N   H2O:  A     P METH:  ESS      SMA:  BLM                CTY:  NATRONA
       LS CA N:  WYC011111A         RNG:  79W   CO2:        D METH:  N  LEASE TYPE:  P          WELL TYPE:
 RMKS:
 RMKS:
 INSPECTION DATE:  89/02/08         2ND INSPECTION DATE:              SPUD DATE:          COMPLETION DATE:
   PLUGGING DATE:                 SITE RESTORATION DATE:                              STATUS CHANGE DATE:
```

Inspection Report Sample

```
                              FACILITY RECORD(S) FOR 000000000A
```

Note: The "A" below, under ID, is the Facility Identifier.

```
-----------------------------------------------------------------------------------------------------
        QTR        TYPE  OIL   TANK   WTR      HTR       DSP EMR  GAS       RUN FAC  INSP     SEAL REC
  ID    QTR   SEC  STOR  TKS   CAP    TKS  SEP TRT  DHY  PIT PIT  MTR  LACT BRL DIA  DATE     REVIEW DT
-----------------------------------------------------------------------------------------------------
   A   S  0   1600  2     0     0     0    1   1   0    1    4   Y  09/02/08             NWSE  26
 OTH EQUIP:
 REMARKS 1:  MTR PROV,#20 870506,880504,880805,890208,890208,891108
 REMARKS 2:  OIL PIPELND
 METER STATION NO. 1  METER STATION NO. 2  METER STATION NO. 3  METER STATION NO. 4  METER STATION NO. 5  METER STATION NO. 6


*****************************************************************************************************
                              APPROVAL RECORD(S) FOR 000000000A

 APPROVAL TYPE: DN   APPROVAL DATE: 86/03/06   REMARKS:
                                                  NTL-2B UNLINED PITS, LACT 20 NWSE 26-40N-79W-QUALIFIES UNDER
                                                  EXCEP 5 OF PT IV, NPDES WY-0011111 (90)
 APPROVAL TYPE: EP   APPROVAL DATE: 76/11/11  REMARKS:
                                                  EMERGENCY PIT
 APPROVAL TYPE: MO   APPROVAL DATE: 58/10/16  REMARKS:
                                                  MEASUREMENT OF OIL - OTHER
 APPROVAL TYPE: SO   APPROVAL DATE: 58/10/16  REMARKS:
                                                  PROD STORED OFF LSE - OIL

*****************************************************************************************************
                              INSPECTION PRIORITY(S) FOR 000000000A

-----------------------------------------------------------------------------------------------------
                         HLTH  OTH         OTH  OTHER STANDARD            OPER  OVL  AVG MONTHLY PROD
YR RANK  FREQ  PROD  ENV SFTY  RESRC LEGAL STD  REMARKS                   COMP  PRI  OIL          GAS
-----------------------------------------------------------------------------------------------------
91        A     H     H    H     L     L    L                              L     W    27061         0
90        A     H     H    H     L     L    H                              H     W    40826         0
89        A     H     H    H     L     L       EV, MV, UE, DD              H     B    38373         0
87 0003   A     H     H    H     L     L       EV, MV, UE, DD              H     B    41406         0
86    3   A     H     H    H     L     L                                   L     B    35915         0
*****************************************************************************************************
                              INCIDENTS OF NON-COMPLIANCE FOR 000000000A
```

Note: If there are no outstanding uncorrected INC's, no INC report will be printed.

```
                              INCIDENTS OF NON-COMPLIANCE FOR 000000000A
 UNIQ: JTEFY91001     TWN: 79W    IPRE: PC   GRAVITY: MAJOR     ATCH BOND:     IDENTFY DT: 90/12/12   CORRCT DT:
 INSP: EVANS          RNG: 79W    INUM: 20   ASM SCH:           TRM LEASE:      EFFECT DT: 90/12/12   APPEAL DT:
 WELL: 08TPSE26       SEC:  26    TYPE: 0    ASM AMT:      0    SHUT DOWN:     ABATEMT DT: 90/12/12   TPR FL DT:
  FAC: A              QTR: NWSE   FORM: 1    PENALTY:        0  BIA CNCUR:     BIA REL DT:            FOLLOW DT:
                     FROM:                                          .          1ST EXT DT:            2ND EXT DT:
 REMARKS:          FOL REM: INC HAND DELIVERED                                 3RD EXT DT:            FOL TRIPS:  0
            COMMINGLING ON LEASE NOT APPROVED.
```

Data Base Name: AIRSPI

Current Physical Schema Diagram

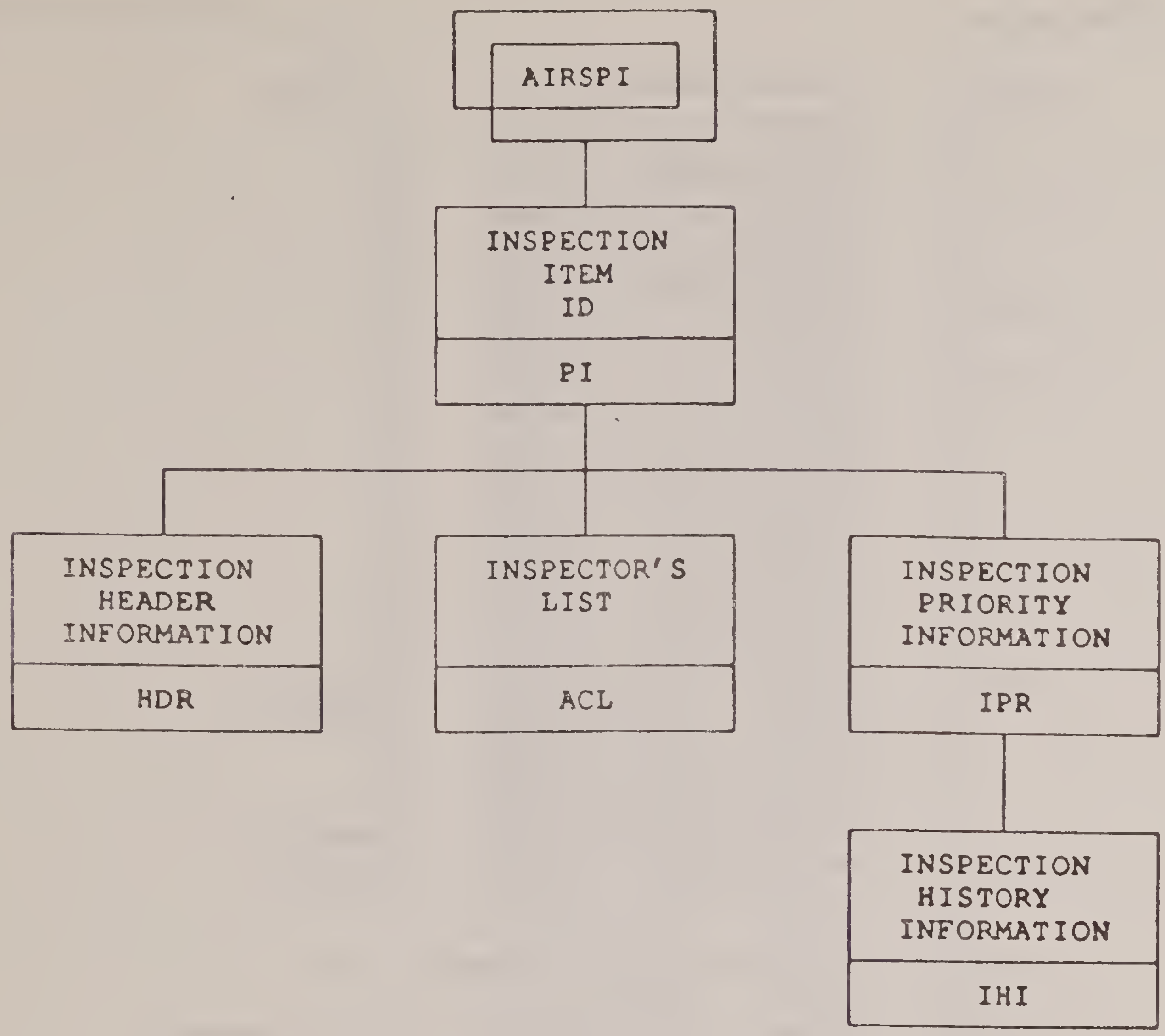

AIRSPI
INSPECTION ITEM ID
PI
INSPECTION HEADER INFORMATION
HDR
INSPECTOR'S LIST
ACL
INSPECTION PRIORITY INFORMATION
IPR
INSPECTION HISTORY INFORMATION
IHI

Exhibit A-2: Current Physical Schema Diagram

HDR.DAT ASCII File Layout

ELEMENT NAME		PICTURE
PI_IN_ITEM	RPII	A25
H_OPERATOR	HOPR	A30
H_MIN_OWN	HMIO	I3
H_CLASS	HCLS	A1
H_LEASE_NAME	HLNM	A35
H_STATE	HSTA	A2
H_COUNTY	HCNT	A15
H_TOWNSHIP	HTWN	A5
H_RANGE	HRNG	A5
H_SECTION	HSEC	I3
H_QTR_QTR	HQTR	A4
H_MERIDIAN	HMER	A15
H_HAZ_PRES	HHPR	A1
H_ROY_FORV	HRFV	A1
H_CONTR_NO	HCNO	A25
H_IND_AGENCY	HIAG	A3
H_LEAS_STAT	HLST	A1
H_LEAS_ST_DT	HLSD	YYMMDD6
H_SUR_TI_LAT	HSLA	A7
H_SUR_TI_LON	HSLO	A7
H_RESRC_AREA	HRSA	A3
H_OPR_TRN_DT	HOTD	YYMMDD6
H_OPR_EFF_DT	HOED	YYMMDD6

Number of data elements = 23

Total record length = 209 characters

Estimated number of records = 6

Estimated maximum file size = 1,254 bytes

ACL.DAT ASCII File Layout

```
ELEMENT NAME                     PICTURE
-------------------              -------
PI_IN_ITEM        RPII           A25
AC_PIT_APPVD      CPAP           A1
AC_PIT_AI_DT      CIAD           YYMMDD6
AC_MES_ON_OF      CMNF           A1
AC_MEASOF_AP      CMOA           A1
AC_OFM_AI_DT      COID           YYMMDD6
AC_OIL_MM_AP      COMA           A1
AC_MM_AI_DT       CMID           YYMMDD6
AC_LACT_METR      CLAM           A1
AC_TANK_GAGE      CTGA           A1
AC_L_OTHER        COTH           A1
AC_STR_ON_OF      CSNF           A1
AC_STORF_AP       CSFA           A1
AC_OSS_AI_DT      COAD           YYMMDD6
AC_CML_ON_OF      CCNF           A1
AC_COMLNG_AP      CCOA           A1
AC_COM_AI_DT      CCID           YYMMDD6
AC_GAS_SOLD       CGSO           A1
AC_USED_ONLE      CUON           A1
AC_FLAR_VENT      CFLV           A1
AC_DISP_OTH       CDOT           A1
AC_DISPOS_AP      CDAP           A1
AC_GDM_AI_DT      CDID           YYMMDD6
AC_GAS_ON_OF      CGNF           A1
AC_GAS_OF_AP      CGFA           A1
AC_OLM_AI_DT      CGID           YYMMDD6
AC_GAS_MM_AP      CGMA           A1
AC_MMG_AI_DT      CMAD           YYMMDD6
AC_ORIFICE        CORF           A1
AC_TURBINE        CTUR           A1
AC_ESTIMATED      CEST           A1
AC_G_OTHER        CMOT           A1
AC_H2O_DS_AP      CHDA           A1
AC_H2O_AI_DT      CHID           YYMMDD6
AC_H2O_UNLIN      CHUN           A1
AC_H2O_LINED      CHLI           A1
AC_H2O_SUBSR      CHSR           A1
AC_H2O_OTHER      CHOT           A1
AC_GAS_STRM       CGSS           A6
AC_STV            CSTV           A6
AC_REMARKS        CREM           A60
AC_REMARKS_2      CRE2           A60
-------------------              ----

Number of data elements = 42

Total record length = 239 characters

Estimated number of records = 6

Estimated maximum file size = 1,434 bytes
```

IPR.DAT ASCII File Layout

```
ELEMENT NAME              PICTURE
-------------------       -------
PI_IN_ITEM     RPII       A25
IP_PRIRTY_YR   IPPY       A2
IP_OALL_RNK    IPOR       A4
IP_FREQ        IPFQ       A1
IP_PROD        IPPR       A1
IP_ENVIR       IPEV       A1
IP_SAFETY      IPHS       A1
IP_OTH_RES     IPOT       A1
IP_LEGAL       IPLG       A1
IP_OTH_STD     IPOS       A1
IP_OVRAL_PRI   IPOP       A2
IP_OPR_COMPR   IPON       A1
IP_AV_MO_GAS   IPAG       I9
IP_AV_MO_OIL   IPAO       I9
IP_OT_STD_RE   IPRM       A40
IP_REMARKS_2   IPR2       A60
-------------------       ----

Number of data elements = 16

Total record length = 159 characters

Estimated number of records = 23

Estimated maximum file size = 3,657 bytes
```

IHI.DAT ASCII File Layout

ELEMENT NAME		PICTURE	
PI_IN_ITEM	RPII	A25	
IP_PRIRTY_YR	IPPY	A2	
IH_INSP_NUM	PINO	A5	
IH_OPEN_DT	PIOD	YYMMDD6	
IH_CLOSE_DT	PICD	YYMMDD6	
IH_INSPECTOR	PIIN	A15	
IH_TYP_INSP	PTYI	A2	
IH_ACTIVTY_C	PATC	A2	
IH_SOURCE_CD	PSOC	A3	
IH_WELL_NO_I	PWNI	A10	
IH_FACI_ID_I	PFII	A6	
IH_OFFICE_TM	POFT	D9.1	Decimal included in 9 character field (9999999.9)
IH_TRAVEL_TM	PTRT	D9.1	
IH_INSPCT_TM	PINT	D9.1	
IH_NO_TRIPS	PTRP	I8	
IH_PUR_CONTR	PPUC	A30	
IH_REFERRALS	PRFS	A3	
IH_GAS_GAIND	PGSG	I6	
IH_OIL_GAIND	POLG	I6	
IH_GAS_LOST	PGSL	I6	
IH_OIL_LOST	POLL	I6	
IH_GAS_RECOV	PGSR	I6	
IH_OIL_RECOV	POLR	I6	
IH_REMARKS	PREM	A60	
IH_REMARKS_2	PRE2	A60	

Number of data elements = 25

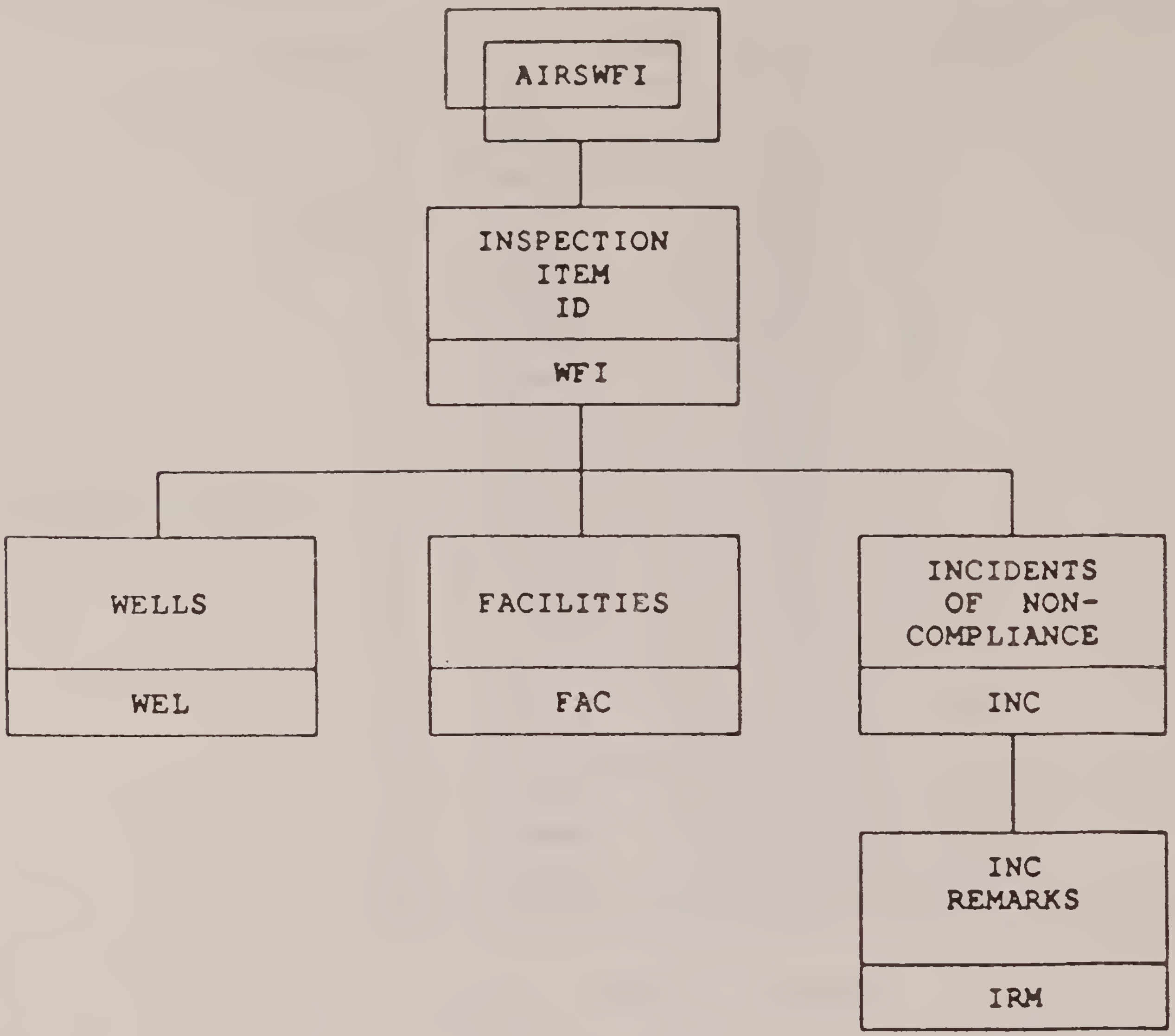
Total record length = 306 characters

Estimated number of records = 23

Estimated maximum file size = 7,038 bytes

Data Base Name: AIRSWFI

Current Physical Schema Diagram



WEL.DAT ASCII File Layout

ELEMENT NAME		PICTURE
WFI_IN_ITEM	RWII	A25
W_API_INT_NO	WAIN	I4
W_API_WEL_NO	WAPI	A14
W_WELL_NO	WWNO	A10
W_WELL_NAME	WWNM	A15
W_LSE_CA_NM	WLNM	A20
W_FACLOC_CO2	WFLC	A6
W_WELL_STAT	WWST	A5
W_FACLOC_GAS	WFLG	A6
W_FACLOC_OIL	WFLO	A6
W_FACLOC_H2O	WFLW	A6
W_DISP_METH	WDMT	A1
W_FLD_POOL	WFPL	A20
W_COUNTY	WCNT	A15
W_TOWNSHIP	WTWN	A5
W_HALF_TWN	WHTN	A1
W_RANGE	WRNG	A5
W_HALF_RNG	WHRG	A1
W_SECTION	WSEC	I3
W_QTR_QTR	WQTR	A4
W_INSP_DT	WSPD	YYMMDD6
W_COMLNG_MZ	WCMZ	A1
W_NUM_COMPL	WNUM	A2
W_PROD_METH	WPMT	A3
W_PROD_ZONE	WPZN	A6
W_BOT_HO_LOC	WBHL	A16
W_TRACT_NUM	WTRN	A10
W_REMARKS	WREM	A40
W_REMARKS_2	WRE2	A60
W_REMARKS_3	WRE3	A60
W_ADD_TRN_DT	WATD	YYMMDD6
W_ADD_EFF_DT	WAED	YYMMDD6
W_CHG_TRN_DT	WCTD	YYMMDD6
W_CHG_EFF_DT	WCED	YYMMDD6
W_SC_TRN_DT	WSTD	YYMMDD6
W_SC_EFF_DT	WSED	YYMMDD6
W_INSP2_DT	WS2D	YYMMDD6
W_TYPE	WTYP	A1
W_SURF_MGT_A	WSMA	A8
W_TYPE_LEASE	WTYL	A2
W_REMARKS_4	WRE4	A60
W_SPUD_DT	WSDD	YYMMDD6
W_COMPLET_DT	WCPD	YYMMDD6
W_PLUG_DT	WPLD	YYMMDD6
W_SITERST_DT	WSRD	YYMMDD6
W_STATUSC_DT	WSCD	YYMMDD6

Number of data elements = 46

Total record length = 519 characters

Estimated number of records = 17

Estimated maximum file size = 8,823 bytes

FAC.DAT ASCII File Layout

ELEMENT NAME		PICTURE
WFI_IN_ITEM	RWII	A25
F_FAC_ID	FFID	A6
F_SECTION	FSEC	I3
F_QTR_QTR	FQTR	A4
F_INSP_DT	FSPD	YYMMDD6
F_TYPE_STOR	FSTT	A1
F_OIL_TANKS	FOTK	I2
F_TOTANK_CAP	FTKC	I6
F_WATER_TANK	FWTK	I2
F_SEPARATOR	FSEP	I2
F_GUN_BARREL	FGBR	I2
F_GAS_METER	FGMT	I2
F_HEAT_TREAT	FHTR	I2
F_LACT_UNIT	FLTU	I1
F_DEHYDRATOR	FDHR	I2
F_DISPOS_PIT	FDSP	I2
F_EMERG_PIT	FEMP	I2
F_OTH_EQUIP	FOTF	A40
F_FAC_DIAG	FFDI	A1
F_REVD_DT	FSRD	YYMMDD6
F_REMARKS	FREM	A60
F_REMARKS_2	FRE2	A60
F_METER_SN_1	FMS1	A15
F_METER_SN_2	FMS2	A15
F_METER_SN_3	FMS3	A15
F_METER_SN_4	FMS4	A15
F_METER_SN_5	FMS5	A15
F_METER_SN_6	FMS6	A15
F_TOWNSHIP	FTWN	A5
F_RANGE	FRNG	A5

Number of data elements = 30

Total record length = 337 characters

Estimated number of records = 8

Estimated maximum file size = 2,696 bytes

INC.DAT ASCII File Layout

ELEMENT NAME		PICTURE
WFI_IN_ITEM	RWII	A25
I_INC_NUMBER	INUM	A10
I_INSPECTOR	IINR	A15
I_FAC_ID	IFAC	A6
I_WELL_NUM	IWNO	A10
I_TYPE	ITYP	A1
I_GRAVITY	IGRV	I1
I_FORM	IFRM	A2
I_TOWNSHIP	ITWN	A5
I_RANGE	IRNG	A5
I_SECTION	ISEC	I3
I_QTR_QTR	IQTR	A4
I_MERIDIAN	IMER	A15
I_ASSESS_SCH	IASC	A1
I_ASSESS_AMT	IASA	I6
I_PENLTY_AMT	IPNA	I9
I_ATTACH_BND	IABN	A1
I_LINE_IDPRE	ILPR	A2
I_LINE_ID_NO	ILNO	I2
I_BIA_CONCUR	IBIA	A1
I_BIA_REL_DT	IRED	YYMMDD6
I_FOLLOW_DT	IFUD	YYMMDD6
I_FOLLOW_TRP	IFOT	I2
I_FOLLOW_REM	IFUR	A40
I_IDENT_DT	IIDD	YYMMDD6
I_EFFECT_DT	IEFD	YYMMDD6
I_TPR_FIL_DT	ITFD	YYMMDD6
I_APPEAL_DT	IAPD	YYMMDD6
I_ABATE_DT	IABD	YYMMDD6
I_CORRECT_DT	ICRD	YYMMDD6
I_TERM_LEASE	ITER	A1
I_SHUT_DOWN	ISHU	A1
I_EXT1_DT	IE1D	YYMMDD6
I_EXT2_DT	IE2D	YYMMDD6
I_EXT3_DT	IE3D	YYMMDD6

Number of data elements = 35

Total record length = 234 characters

Estimated number of records = 10

Estimated maximum file size = 2,340 bytes

IRM.DAT ASCII File Layout

```
ELEMENT NAME              PICTURE
-------------------       -------
WFI_IN_ITEM     RWII      A25
I_INC_NUMBER    INUM      A10
I_REM_NUM       IRNU      I1S
I_REMARKS       IREM      A60
-------------------       ----

Number of data elements = 4

Total record length = 96 characters

Estimated number of records = 11

Estimated maximum file size = 1,056 bytes
```

Total estimated size of all 8 data files = 28,298 bytes

Data Base Name: AIRSPI

2	**HDR.DAT ASCII File Layout**	Total record length = 209 characters Estimated number of records = 6 Estimated maximum file size = 1,254 bytes
3	**ACL.DAT ASCII File Layout**	Total record length = 239 characters Estimated number of records = 6 Estimated maximum file size = 1,434 bytes
4	**IPR.DAT ASCII File Layout**	Total record length = 159 characters Estimated number of records = 23 Estimated maximum file size = 3,657 bytes
5	**IHI.DAT ASCII File Layout**	Total record length = 306 characters Estimated number of records = 23 Estimated maximum file size = 7,038 bytes

Data Base Name: AIRSWFI

6	**WEL.DAT ASCII File Layout**	Total record length = 519 characters Estimated number of records = 17 Estimated maximum file size = 8,823 bytes
7	**FAC.DAT ASCII File Layout**	Total record length = 337 characters Estimated number of records = 8 Estimated maximum file size = 2,696 bytes
8	**INC.DAT ASCII File Layout**	Total record length = 234 characters Estimated number of records = 10 Estimated maximum file size = 2,340 bytes
9	**IRM.DAT ASCII File Layout**	Total record length = 96 characters Estimated number of records = 11 Estimated maximum file size = 1,056 bytes

Table Descriptions

This section describes all of the data elements contained in AIRS. It is organized alphabetically by Long Name.

There is one data element on each page. The following list indicates the information that can be found on each data element:

Long Name - The field name assigned to the data element.

Short Name - An abbreviated name assigned to the data element, and used in all the AIRS programs.

English Name - A name assigned to each element to try to give some meaning to it. If this name does not clarify the usage of the data element in AIRS, refer to the "Definition" farther down the page.

Database - What database within AIRS contains this data element.

Segment - What segment within an AIRS database contains this data element.

Format - The format of the data element. The notation used for the format is Cnn where C is the characteristic, and nn is the length. C can be either A for alpha-numeric fields, I for integer fields, or D for decimal fields. Decimal fields are defined as Dx.y, where x is the total field length including the actual decimal point, "." is the ASCII character for a period, and y is the number of decimal places to the right of the decimal point.

Valid Codes - The codes listed here are the codes that should be used in AIRS. If the field is edited in AIRS, it is so stated under this heading, and the valid codes are listed here.

Required - R = Required, O = Optional.

Criticalness Level - There are three levels of criticalness as follows:

Level 1 means that entry is mandatory and critical to the I & E program and 100% accuracy is required. Data elements in this group would be items such as the class of an IID, the name of the operator of an IID, the API well number, the status of a well, and Priority rankings for an IID. Many of these fields are edited and coded and often required to be completed before a record can be updated.

Level 2 means that entry is mandatory but not critical to the I & E program and 95% accuracy is required. Data elements in this group would be items such as an operator's well name, operator address information, numbers of certain equipment type on the facility, certain INC information, and remarks informing MMS of a change to an API well number or agreement information required by WO IM 88-317 or 317 change 1.

Level 3 means that entry is optional and not critical to the I & E program and 85% accuracy is required.

Source - Indicates the source (external to AIRS) of the data. Codes are as follows:

A = INSPECTION RESULT
B = 3160-4 COMPLETION FORM
C = 3160-5 SUNDRY FORM
D = 3160-3 APPLICATION FOR PERMIT TO DRILL
E = INCIDENT OF NONCOMPLIANCE/VIOLATION LETTER
F = OTHER
G = FILE SEARCH
H = SYSTEM GENERATED
I = DATA ENTRY GENERATED
J = OPERATOR SUBMITTED LETTER
K = 3160-6 MONTHLY REPORT OF OPERATIONS

Definition - This is an explanation of the way this field is to be used in AIRS.

rm 3160-9
ary 1989)

Number ______________

Page ______ of ______

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

NOTICE OF INCIDENTS OF NONCOMPLIANCE

☐ Certified Mail Return Receipt Requested

☐ Hand Delivered Received by

Identification
Lease
CA
Unit
PA

Bureau of Land Management Office	Operator
Address	Address
Telephone	Attention

Site Name	Well or Facility Identification	¼ ¼ Sec.	Township
Inspector		Range	Meridian

THE FOLLOWING VIOLATION WAS FOUND BY BUREAU OF LAND MANAGEMENT INSPECTORS ON THE DATE AND AT THE SITE LISTED ABOVE.

Date	Time (24-hour clock)	Violation	Gravity of Violation
Corrective Action To be Completed by	Date Corrected	Assessment for Noncompliance	Assessment Reference
		$	43 CFR 3163.1 ( )

arks:

When violation is corrected, sign this notice and return to above address

Company Representative Title ______________ Signature ______________ Date ________

Company Comments ______________

WARNING

Incidents of Noncompliance correction and reporting time frames begin upon receipt of this Notice or 7 business days after the date it is mailed, whichever is earlier. Each violation must be corrected within the prescribed time from receipt of this Notice and reported to the Bureau of Land Management office at the address shown above. Please note that you already may have been assessed for noncompliance (see amount under "Assessment for Noncompliance"). If you do not comply as noted above under "Corrective Action To Be Completed By," you may incur an additional assessment under (43 CFR 3163 1) and may also incur Civil Penalties (43 CFR 3163 2). All self-certified corrections must be postmarked no later than the next business day after the prescribed time for correction.

Section 109(d)(1) of the Federal Oil and Gas Royalty Management Act of 1982, as implemented by the applicable provisions of the operating regulations at Title 43 CFR 3163.2(f)(1), provides that any person who "knowingly or willfully" prepares, maintains, or submits false, inaccurate, or misleading reports, notices, affidavits, records, data, or other written information required by this part shall be liable for a civil penalty of up to $25,000 per violation for each day such violation continues, not to exceed a maximum of 20 days.

REVIEW AND APPEAL RIGHTS

A person contesting a violation shall request a State Director review of the Incidents of Noncompliance. This request must be filed within 20 working days of receipt of the Incidents of Noncompliance with the appropriate State Director (see 43 CFR 3165 3). The State Director review decision may be appealed to the Interior Board of Lands Appeals, 4015 Wilson Blvd., Arlington, VA 22203 (see 43 CFR 3165 4). Contact the above listed Bureau of Land Management office for further information.

ature of Bureau of Land Management Authorized Officer	Date	Time

FOR OFFICE USE ONLY

Number	Date	Assessment	Penalty	Termination

Type of Inspection:

Exhibit A-3: Form 3160-9 - Notice of Incidents of Noncompliance

EXHIBIT C-1: CPU PRECISION PROGRAMS FOR FD 13

FILE IBMTST1.F77 LISTING

```
      PROGRAM IBM TEST 1
      DOUBLE PRECISION R,S,T,U,V,W,X,Y,Z
      R = 1.98765432198765432198765432lQ34
      S = R*R
      T = R**2.Q00
      U = SQRT(S)
      V = SQRT(T)
      W = S**0.5Q00
      X = T**0.5Q00
      Y = W*W
      Z = W**2.Q00
      PRINT*,R
      PRINT*,S
      PRINT*,T
      PRINT*,U
      PRINT*,V
      PRINT*,W
      PRINT*,X
      PRINT*,Y
      PRINT*,Z
      J = 2
      Z = W**J
      PRINT*,Z
      PRINT*,' '
      PRINT*,' '
      R = 1.98765432198765432198765432lQ35
      S = R*R
      T = R**2.Q00
      U = SQRT(S)
      V = SQRT(T)
      W = S**0.5Q00
      X = T**0.5Q00
      Y = W*W
      Z = W**2.Q00
      PRINT*,R
      PRINT*,S
      PRINT*,T
      PRINT*,U
      PRINT*,V
      PRINT*,W
      PRINT*,X
      PRINT*,Y
      PRINT*,Z
      J = 2
      Z = W**J
```

```
PRINT*,Z
PRINT*,' '
PRINT*,' '
R = 1.98765432198765432198765432 1Q36
S = R*R
T = R**2.Q00        U = SQRT(S)
V = SQRT(T)
W = S**0.5Q00
X = T**0.5Q00
Y = W*W
Z = W**2.Q00
PRINT*,R
PRINT*,S
PRINT*,T
PRINT*,U
PRINT*,V
PRINT*,W
PRINT*,X
PRINT*,Y
PRINT*,Z
J = 2
Z = W**J
PRINT*,Z
PRINT*,' '
PRINT*,' '
R = 1.9876543219876543219876543 21Q37
S = R*R
T = R**2.Q00
U = SQRT(S)
V = SQRT(T)
W = S**0.5Q00
X = T**0.5Q00
Y = W*W
Z = W**2.Q00
PRINT*,R
PRINT*,S
PRINT*,T
PRINT*,U
PRINT*,V
PRINT*,W
PRINT*,X
PRINT*,Y
PRINT*,Z
J = 2
Z = W**J
PRINT*,Z
STOP
END
```

FILE IBMTST1.F77 SAMPLE OUTPUT

```
   1.9876543219877E+0034
   3.9507697037162E+0068
   3.9507697037162E+0068
   1.9876543219876E+0034
   1.9876543219876E+0034
   1.9876543219876E+0034
   1.9876543219876E+0034
   3.9507697037161E+0068
   3.9507697037161E+0068
   3.9507697037161E+0068


   1.9876543219877E+0035
   3.9507697037162E+0070
   3.9507697037162E+0070
   1.9876543219877E+0035
   1.9876543219877E+0035
   1.9876543219876E+0035
   1.9876543219876E+0035
   3.9507697037161E+0070
   3.9507697037161E+0070
   3.9507697037161E+0070


   1.9876543219877E+0036
   3.9507697037162E+0072
   3.9507697037162E+0072
   1.9876543219877E+0036
   1.9876543219877E+0036
   1.9876543219876E+0036
   1.9876543219876E+0036
   3.9507697037161E+0072
   3.9507697037161E+0072
   3.9507697037161E+0072


   1.9876543219877E+0037
   3.9507697037162E+0074
   3.9507697037162E+0074
   1.9876543219876E+0037
   1.9876543219876E+0037
   1.9876543219876E+0037
   1.9876543219876E+0037
   3.9507697037162E+0074
   3.9507697037162E+0074
   3.9507697037162E+0074
```

FILE IBMTST4.F77 LISTING

```
      PROGRAM IBM TEST 1
      DOUBLE PRECISION R,S,T,U,V,W,X,Y,Z
      R = 1.987654321987654321987654321Q50
      S = R*R
      T = R**2.Q00
      U = SQRT(S)
      V = SQRT(T)
      W = S**0.5Q00
      X = T**0.5Q00
      Y = W*W
      Z = W**2.Q00
      PRINT*,R
      PRINT*,S
      PRINT*,T
      PRINT*,U
      PRINT*,V
      PRINT*,W
      PRINT*,X
      PRINT*,Y
      PRINT*,Z
      J = 2
      Z = W**J
      PRINT*,Z
      PRINT*,' '
      PRINT*,' '
      R = 1.987654321987654321987654321Q51
      S = R*R
      T = R**2.Q00
      U = SQRT(S)
      V = SQRT(T)
      W = S**0.5Q00
      X = T**0.5Q00
      Y = W*W
      Z = W**2.Q00
      PRINT*,R
      PRINT*,S
      PRINT*,T
      PRINT*,U
      PRINT*,V
      PRINT*,W
      PRINT*,X
      PRINT*,Y
      PRINT*,Z
      J = 2
      Z = W**J
      PRINT*,Z
      PRINT*,' '
```

```
PRINT*,' '
R = 1.987654321987654321987654321Q52
S = R*R
T = R**2.Q00         U = SQRT(S)
V = SQRT(T)
W = S**0.5Q00
X = T**0.5Q00
Y = W*W
Z = W**2.Q00
PRINT*,R
PRINT*,S
PRINT*,T
PRINT*,U
PRINT*,V
PRINT*,W
PRINT*,X
PRINT*,Y
PRINT*,Z
J = 2
Z = W**J
PRINT*,Z
PRINT*,' '
PRINT*,' '
R = 1.987654321987654321987654321Q53
S = R*R
T = R**2.Q00
U = SQRT(S)
V = SQRT(T)
W = S**0.5Q00
X = T**0.5Q00
Y = W*W
Z = W**2.Q00
PRINT*,R
PRINT*,S
PRINT*,T
PRINT*,U
PRINT*,V
PRINT*,W
PRINT*,X
PRINT*,Y
PRINT*,Z
J = 2
Z = W**J
PRINT*,Z
STOP
END
```

FILE IBMTST4.F77 SAMPLE OUTPUT

```
    1.9876543219877E+0050
    3.9507697037162E+0100
    3.9507697037162E+0100
    1.9876543219876E+0050
    1.9876543219876E+0050
    1.9876543219876E+0050
    1.9876543219876E+0050
    3.9507697037161E+0100
    3.9507697037161E+0100
    3.9507697037161E+0100


    1.9876543219877E+0051
    3.9507697037162E+0102
    3.9507697037162E+0102
    1.9876543219877E+0051
    1.9876543219877E+0051
    1.9876543219876E+0051
    1.9876543219876E+0051
    3.9507697037161E+0102
    3.9507697037161E+0102
    3.9507697037161E+0102


    1.9876543219877E+0052
    3.9507697037162E+0104
    3.9507697037162E+0104
    1.9876543219876E+0052
    1.9876543219876E+0052
    1.9876543219876E+0052
    1.9876543219876E+0052
    3.9507697037162E+0104
    3.9507697037162E+0104
    3.9507697037162E+0104


    1.9876543219877E+0053
    3.9507697037162E+0106
    3.9507697037162E+0106
    1.9876543219876E+0053
    1.9876543219876E+0053
    1.9876543219876E+0053
    1.9876543219876E+0053
    3.9507697037161E+0106
    3.9507697037161E+0106
    3.9507697037161E+0106
```

FILE PRECIS.F77 LISTING

```
*      ESTIMATE OF PRECISION
  300 FORMAT ('1','ESTIMATE OF PRECISION')
  101 FORMAT (F12.9)
  102 FORMAT ('0',3X,I3,F20.5,F30.10)
  202 FORMAT ('0',3X,I3,F20.6,F30.12)
  302 FORMAT ('0',3X,I3,F20.7,F30.14)
  402 FORMAT ('0',3X,I3,F20.8,F30.16)
  103 FORMAT ('0',///)
      DOUBLE PRECISION T0(4),S0
      OPEN (06,FILE='PREC')
      T0(1) = 1.00001D00
      T0(2) = 1.000001D00
      T0(3) = 1.0000001D00
      T0(4) = 1.00000001D00
      WRITE (6,300)
      DO 50 K = 1,4
      S0 = T0(K)
      WRITE (6,103)
      S1 = S0
      J = 0
      GO TO (1, 2, 3, 4) K
    1 WRITE (6,102) J,S1,S0
      GO TO 5
    2 WRITE (6,202) J,S1,S0
      GO TO 5
    3 WRITE (6,302) J,S1,S0
      GO TO 5
    4 WRITE (6,402) J,S1,S0
    5 DO 50 I = 1,15
      S0 = S0*S0
      S1 = S1*S1
      GO TO (10,20,30,40) K
   10 WRITE (6,102) I,S1,S0
      GO TO 50
   20 WRITE (6,202) I,S1,S0
      GO TO 50
   30 WRITE (6,302) I,S1,S0
      GO TO 50
   40 WRITE (6,402) I,S1,S0
   50 CONTINUE
      CLOSE (06)
  100 STOP
      END
```

FILE PRECIS.F77 SAMPLE OUTPUT

```
     0            1.00001                 1.0000100000
     1            1.00002                 1.0000200001
     2            1.00004                 1.0000400006
     3            1.00008                 1.0000800028
     4            1.00016                 1.0001600120
     5            1.00031                 1.0003200496
     6            1.00063                 1.0006402016
     7            1.00125                 1.0012808131
     8            1.00250                 1.0025632668
     9            1.00501                 1.0051331039
    10            1.01005                 1.0102925565
    11            1.02021                 1.0206910497
    12            1.04083                 1.0418102189
    13            1.08333                 1.0853685322
    14            1.17360                 1.1780248507
    15            1.37733                 1.3877425489


     0           1.000001               1.000001000000
     1           1.000002               1.000002000001
     2           1.000004               1.000004000006
     3           1.000008               1.000008000028
     4           1.000015               1.000016000120
     5           1.000031               1.000032000496
     6           1.000061               1.000064002015
     7           1.000122               1.000128008127
     8           1.000244               1.000256032640
     9           1.000488               1.000512130833
    10           1.000977               1.001024523945
    11           1.001955               1.002050097539
    12           1.003913               1.004104397977
    13           1.007841               1.008225642037
    14           1.015743               1.016518945261
    15           1.031735               1.033310766074


     0          1.0000000             1.00000009999999
     1          1.0000000             1.00000019999999
     2          1.0000000             1.00000040000000
     3          1.0000000             1.00000080000017
     4          1.0000000             1.00000160000097
     5          1.0000000             1.00000320000450
     6          1.0000000             1.00000640001923
     7          1.0000000             1.00001280007942
```

```
   8          1.0000000          1.00002560032267
   9          1.0000000          1.00005120130072
  10          1.0000000          1.00010240522300
  11          1.0000000          1.00020482093284
  12          1.0000000          1.00040968381728
  13          1.0000000          1.00081953547539
  14          1.0000000          1.00163974258916
  15          1.0000000          1.00328217393408



   0         1.00000000        1.0000000099999937
   1         1.00000000        1.0000000199999874
   2         1.00000000        1.0000000399999749
   3         1.00000000        1.0000000799999498
   4         1.00000000        1.0000001599998996
   5         1.00000000        1.0000003199998133
   6         1.00000000        1.0000006399997261
   7         1.00000000        1.0000012799998501
   8         1.00000000        1.0000025600013345
   9         1.00000000        1.0000051200092201
  10         1.00000000        1.0000102400446451
  11         1.00000000        1.0000204801941379
  12         1.00000000        1.0000409608077092
  13         1.00000000        1.0000819232931946
  14         1.00000000        1.0001638532978063
  15         1.00000000        1.0003277334435126
```

```
GRID1-GRID2            REQUIRES PRINTING      1 SWATH(S) OF UP TO     32 CELLS
 AND CONTAINS     40 ROWS     32 COLUMNS AND     45 SUBJECTS

    ID          VALUE     FREQUENCY  SYMBOL
     1          27.00          1       1
     2           7.00         76       2
     3           3.00        171       3
     4           4.00        133       4
     5           9.00         37       5
     6           8.00         60       6
     7           6.00         94       7
     8           2.00        183       8
     9          14.00          5       9
    10          16.00          1       0
    11          15.00          1       A
    12          13.00         11       B
    13          12.00         18       C
    14           5.00        128       D
    15           1.00        194       E
    16           0.00         95       F
    17        1940.00          1       G
    18        2117.00          1       H
    19        2120.00          1       I
    20        2123.00          1       J
    21        2146.00          1       K
    22        2038.00          1       L
    23        2050.00          1       M
    24        2139.00          1       N
    25        2178.00          1       O
    26        2176.00          1       P
    27        2179.00          1       Q
    28        2125.00          1       R
    29        2151.00          1       S
    30        2158.00          1       T
    31        2186.00          1       U
    32          11.00         18       V
    33          19.00          1       W
    34          18.00          1       X
    35          22.00          1       Y
    36          23.00          2       Z
    37          10.00         26       a
    38        2210.00          1       b
    39          20.00          1       c
    40        2074.00          1       d
    41        2111.00          1       e
    42        1902.00          1       f
    43        1949.00          1       g
    44        2218.00          1       h
    45        2231.00          1       i
```

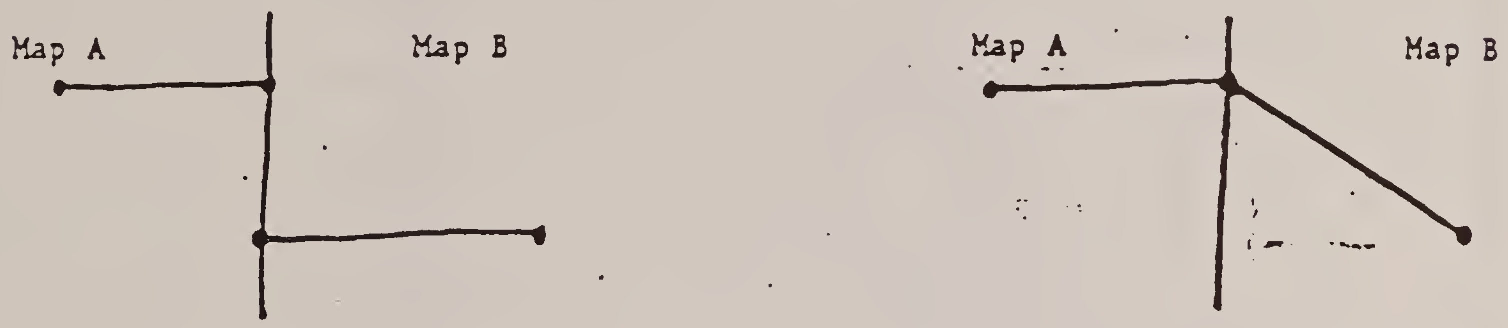
```
Character display of the discrete map: GRID1-GRID2


SWATH  1 COLUMN    1 THROUGH COLUMN   32
 1 f346E635BZ1DaD8dMLHPOKeJISUTRNQb
 2 g5D3E838343EFE3D3E8aD462F3848a8D
 3 GD5732E4E734353FDD34EEa34724Da3X
 4 Y67846DE3883F443Ea5EEE2E8236E8C5
 5 E627583DEVE7F8244E43F783D8C6B343
 6 7533BC7DEFaDE3BD5E28762E352E322E
 7 CB2773V27DED23ED6D888783EE63EDE4
 8 aD63647483FD7D635a74E34483ED248E
 9 5463E884EDE8E77844DDFEE2aD28DDDF
10 77a8E8DFDFE8D4883D44DB8DF7E8aD3E
11 9E82DFED488828587E47288587F34E2E
12 EEF5VE84374VE228338DD2D8D23E4D8E
13 884C6CD2DDC35333ED83838EF58D8D38
14 8F73DB4FF883E8788F3E37833E77D383
15 8DF42FE7F622D46F83FFE68E3ED34688
16 8EDEE3437B8864F374E73422F43D27aF
17 6EEE8586337FDF6264744CFF38883F3E
18 8F8E3D8DEEE4EE8a44E35V46E82F5EE4
19 2E3DF738DDD426DDE88D754F4a84BE24
20 F8DF737836373E68EEED5E378E825884
21 D2F288484E8E8ED388C7FE7EE623364E
22 7C3E6874FE47FDED4E7Da6FE83D88E78
23 FE43EEF2467F4DFE478D8E7EDFDE2365
24 DE83883D88F3D4Ea73E784DED84384E4
25 347F9EF4584843ED63D3EEEE37FE847V
26 375E2EF86386V338F6E62ED4E6DDEEF2
27 E444E45DDDFEDD62V378V88FE844FFDC
28 2354E468336FE86D4888DD3EE38DDEE0
29 734DF633E324DFa5EDE5343E3F853DD4
30 6F42FFc36742EEFE78BD8328D383E33Z
31 463E778DC3F7D78DE74F4DF244288473
32 23D8C7232884aE4BV8448EE3826363FV
33 FE73E3FF9V5422338E7FD3763828866C
34 a38F4F764338VE88F8E887E448EEF4E3
35 333428497E85643E8833E3E4D883aE8D
36 CF73E77E8ED753F38E7FE3CEF32AE242
37 F5EEaa443D67VE697F4DF83V87FEE22a
38 C38347833E48D8F227D428EE8E84F3D4
39 242DEE3F32423E726Da7EF544DaEEE6i
40 737888DWC74V73844V5V43EE7FE338Dh
```

Character display for discrete map GRID1-GRID2, showing only those cells that have values larger than acceptable limit:

```
 1 f              dMLHPOKeJISUTRNQb
 2 g
 3 G
 4
 5
 6
 7
 8
 9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39                                i
40                                h
```

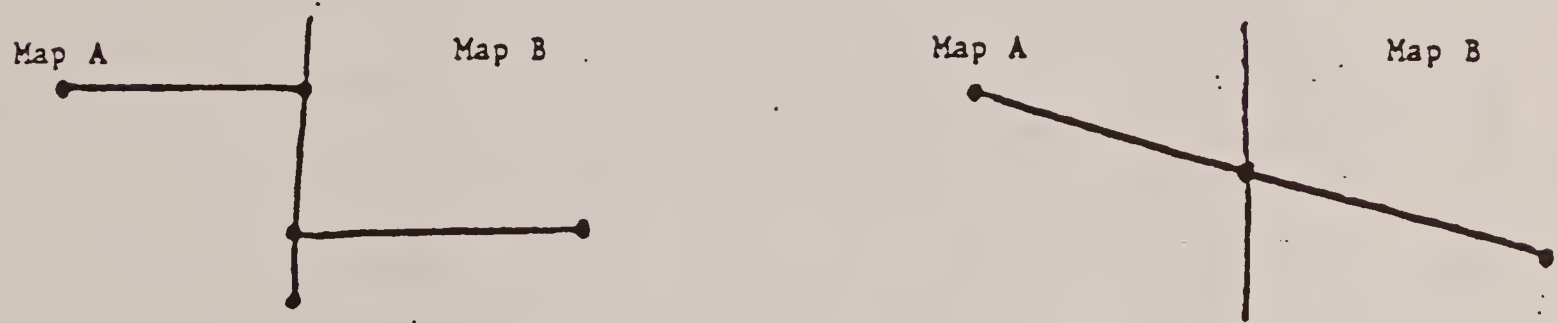
ATTACHMENT 1

LINE CONNECTOR OPTION (Example 1)



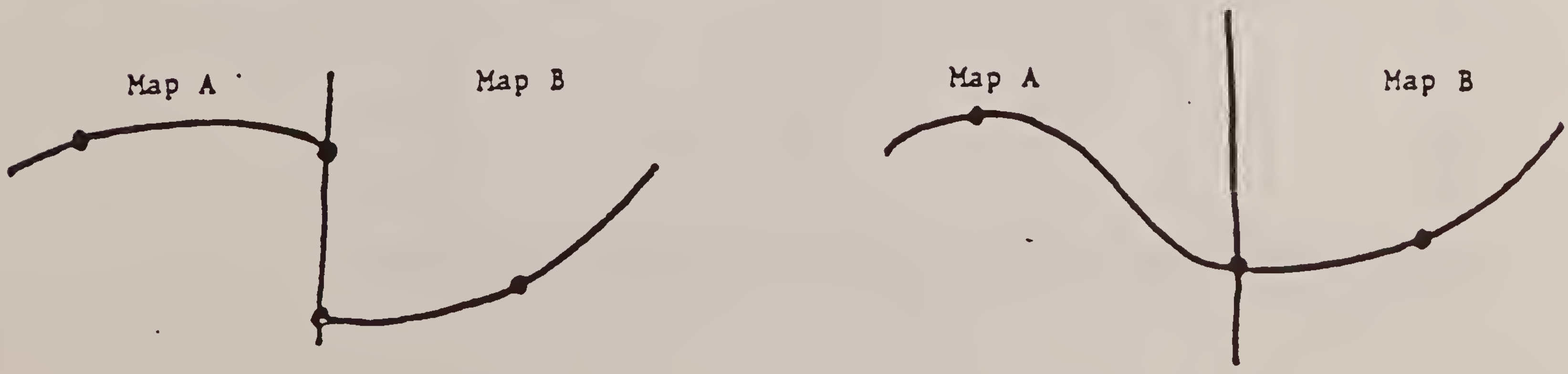
Before After

MID-POINT OPTION (Example 2)



Before After

SMOOTH OPTION (Example 3)



Before After

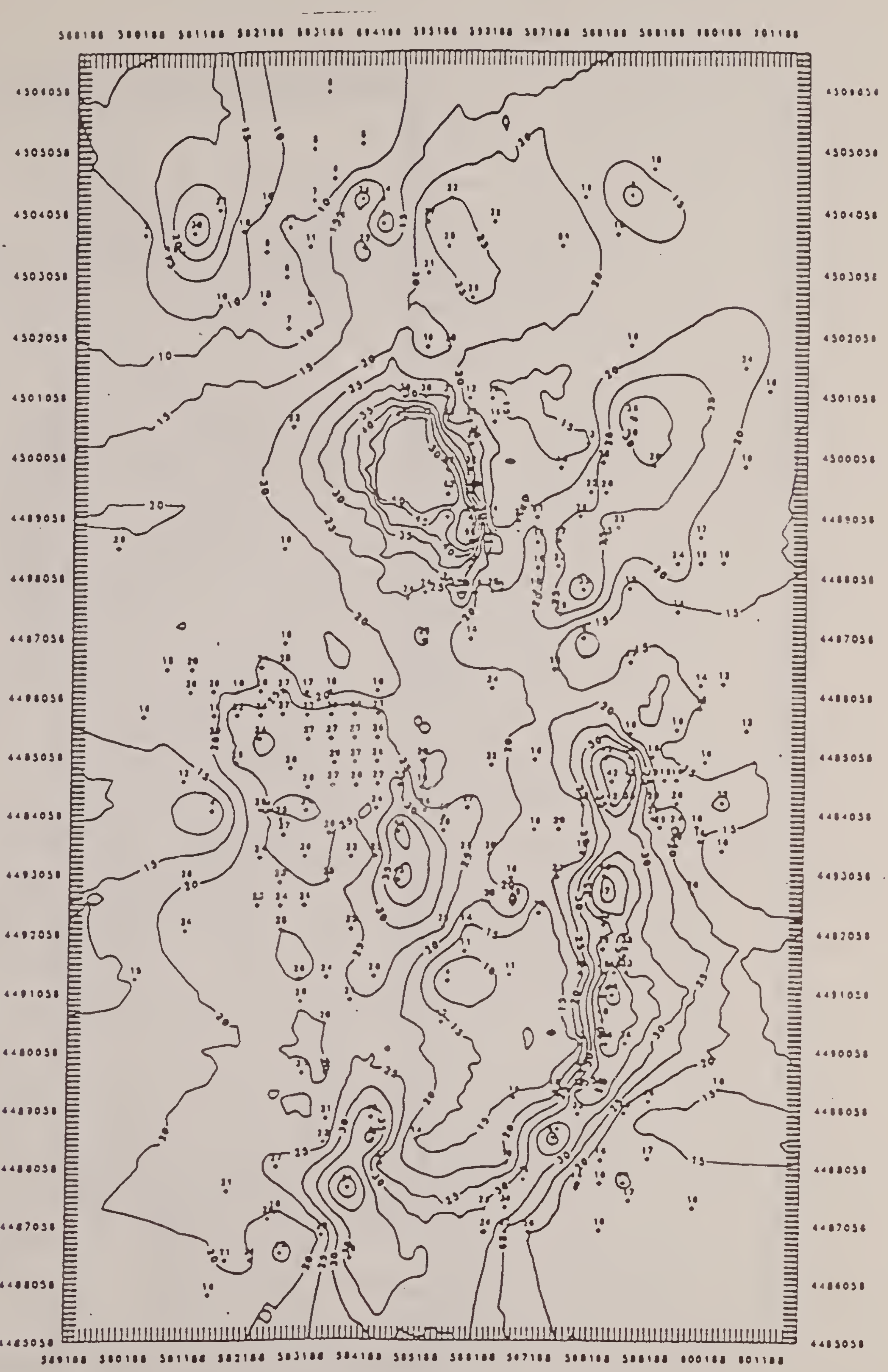


Figure 1

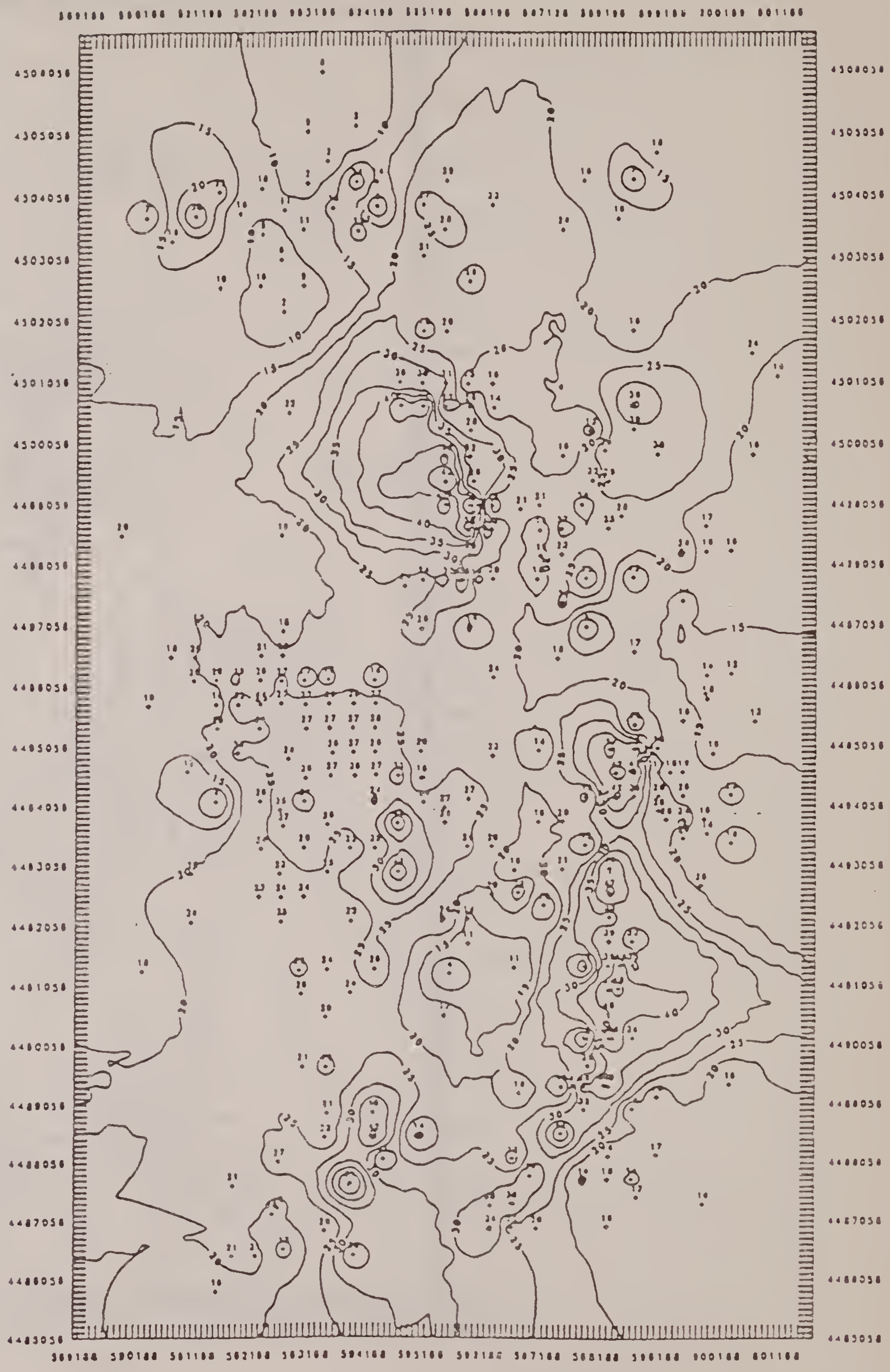


Figure 2

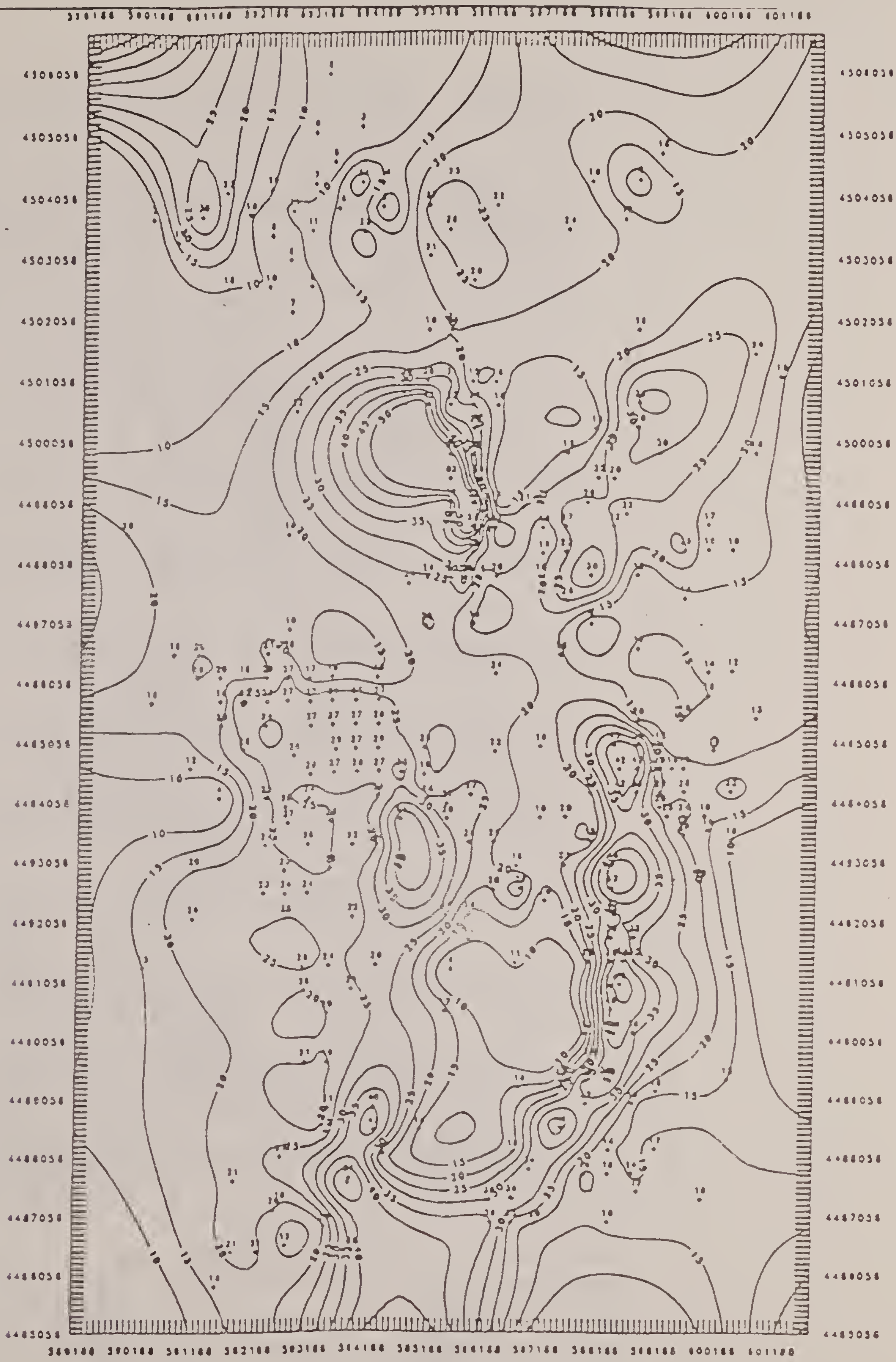
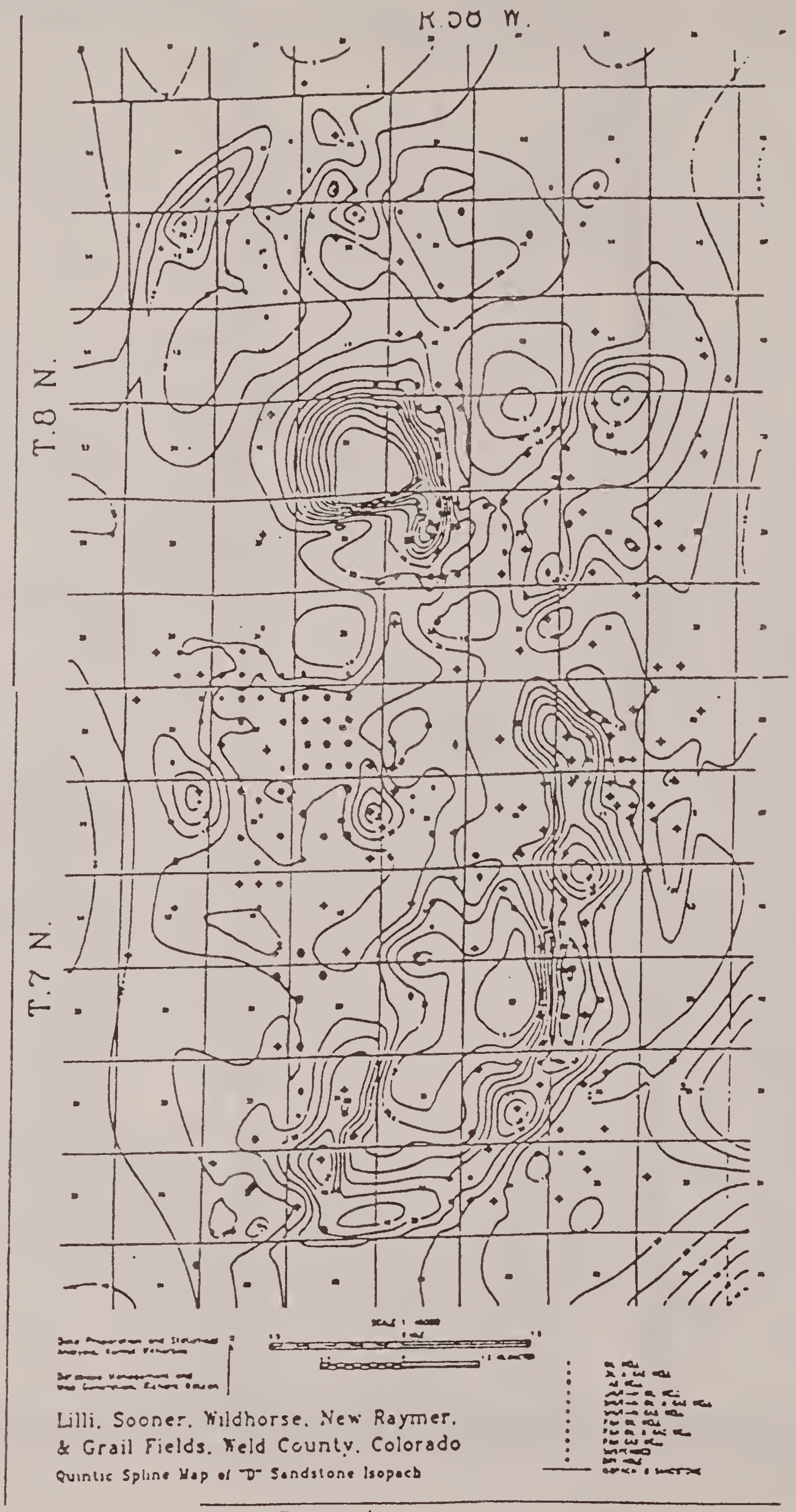


Figure 3



Lilli, Sooner, Wildhorse, New Raymer, & Grail Fields, Weld County, Colorado

Quintic Spline Map of "D" Sandstone Isopach

Figure 4

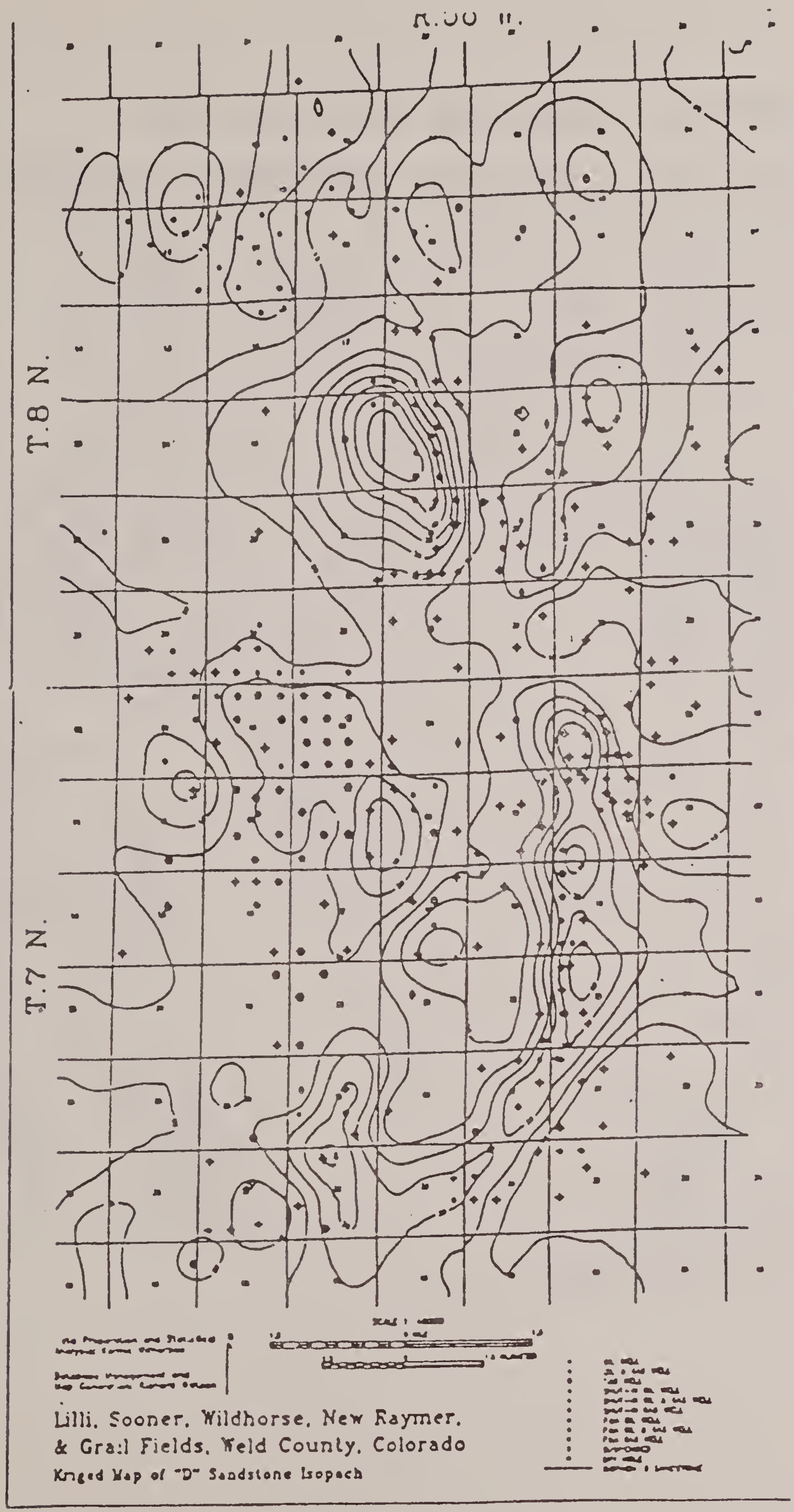

T.8 N.
T.7 N.
Lilli, Sooner, Wildhorse, New Raymer, & Grail Fields, Weld County, Colorado
Kriged Map of "D" Sandstone Isopach

Figure 5

FIGURE 6. CONTOUR MAP WITH FAULT LINES

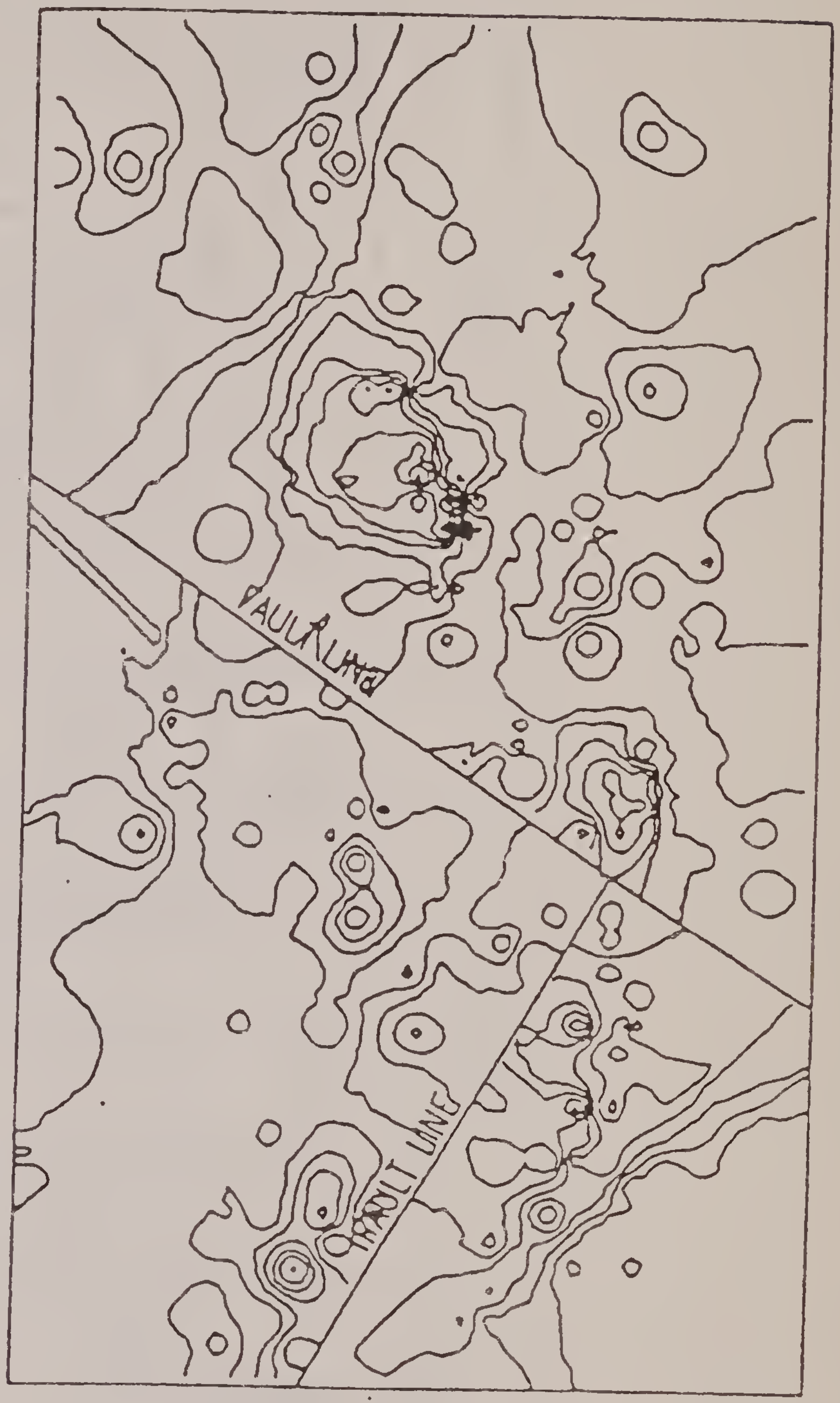


FIGURE 7. CONTOUR MAP WITH ANGULAR LINES BEFORE SMOOTHING ROUTINE

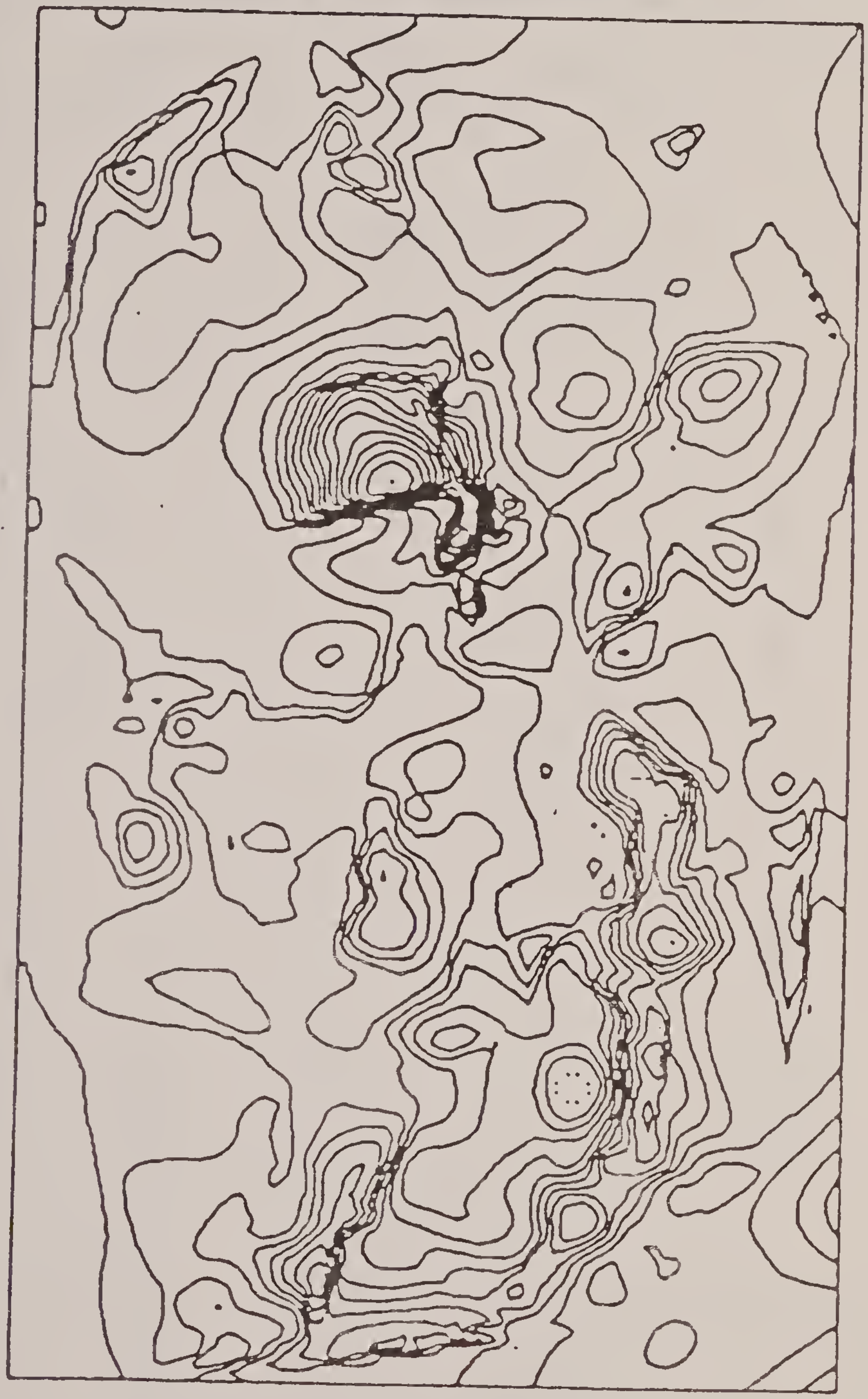


FIGURE 8. CONTOUR MAP WITH SMOOTHED LINES AFTER SMOOTHING ROUTINE

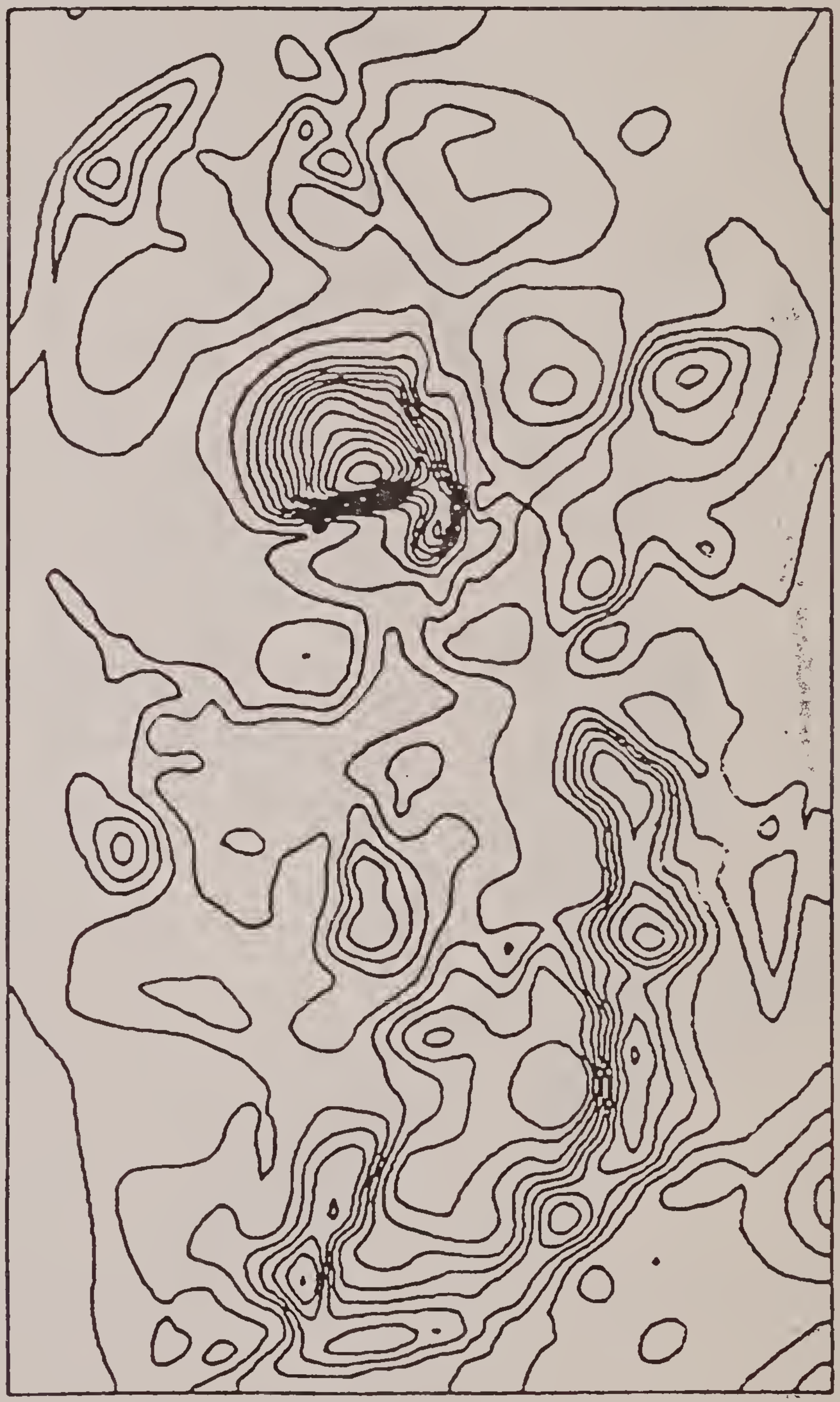


FIGURE 9. CONTOUR MAP BEFORE EDITING. (SEE FIGURE 10 FOR EDITED MAP)

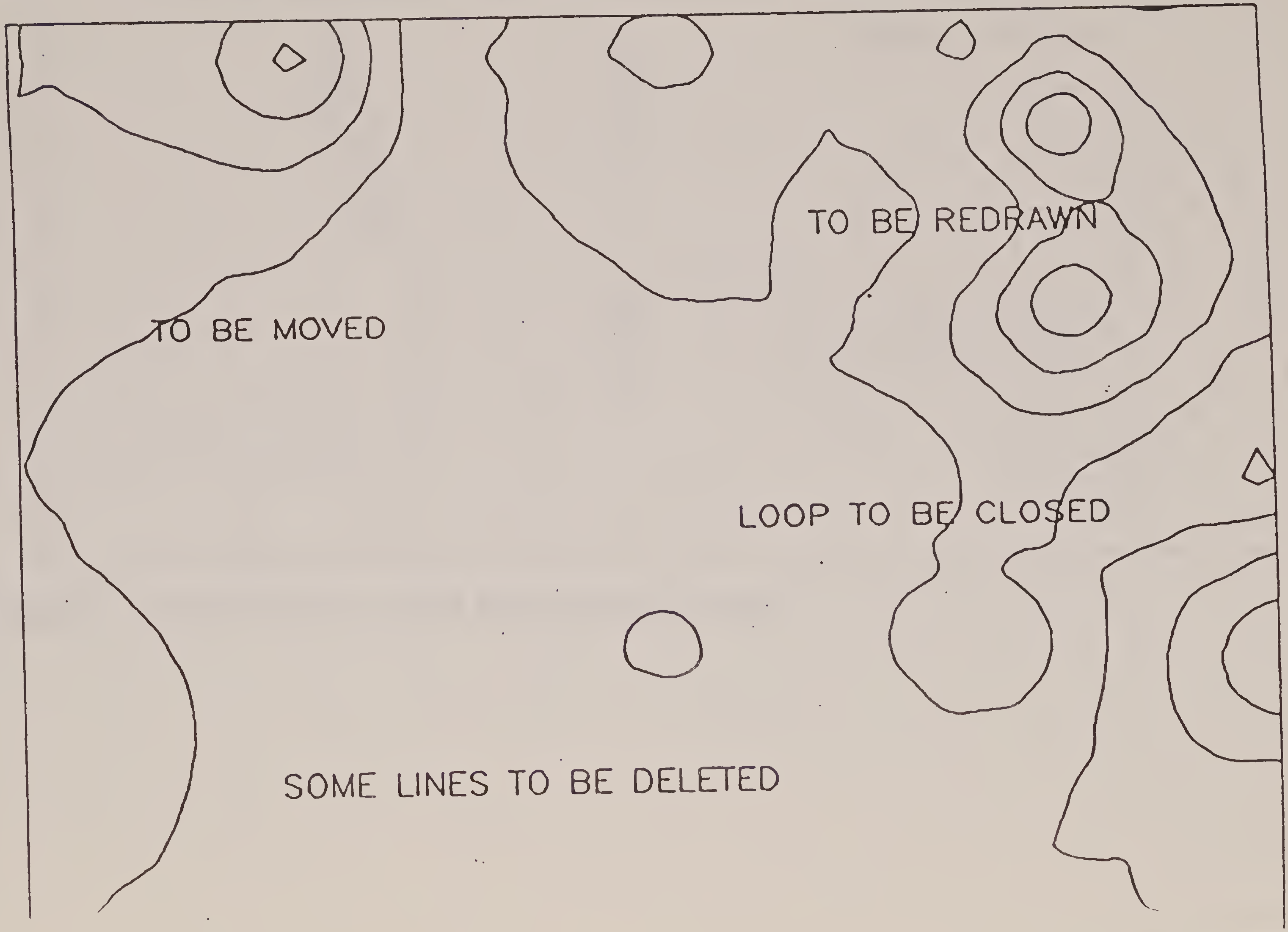


FIGURE 10. MAP IN FIG. 9 AFTER EDITING WITH CURSOR

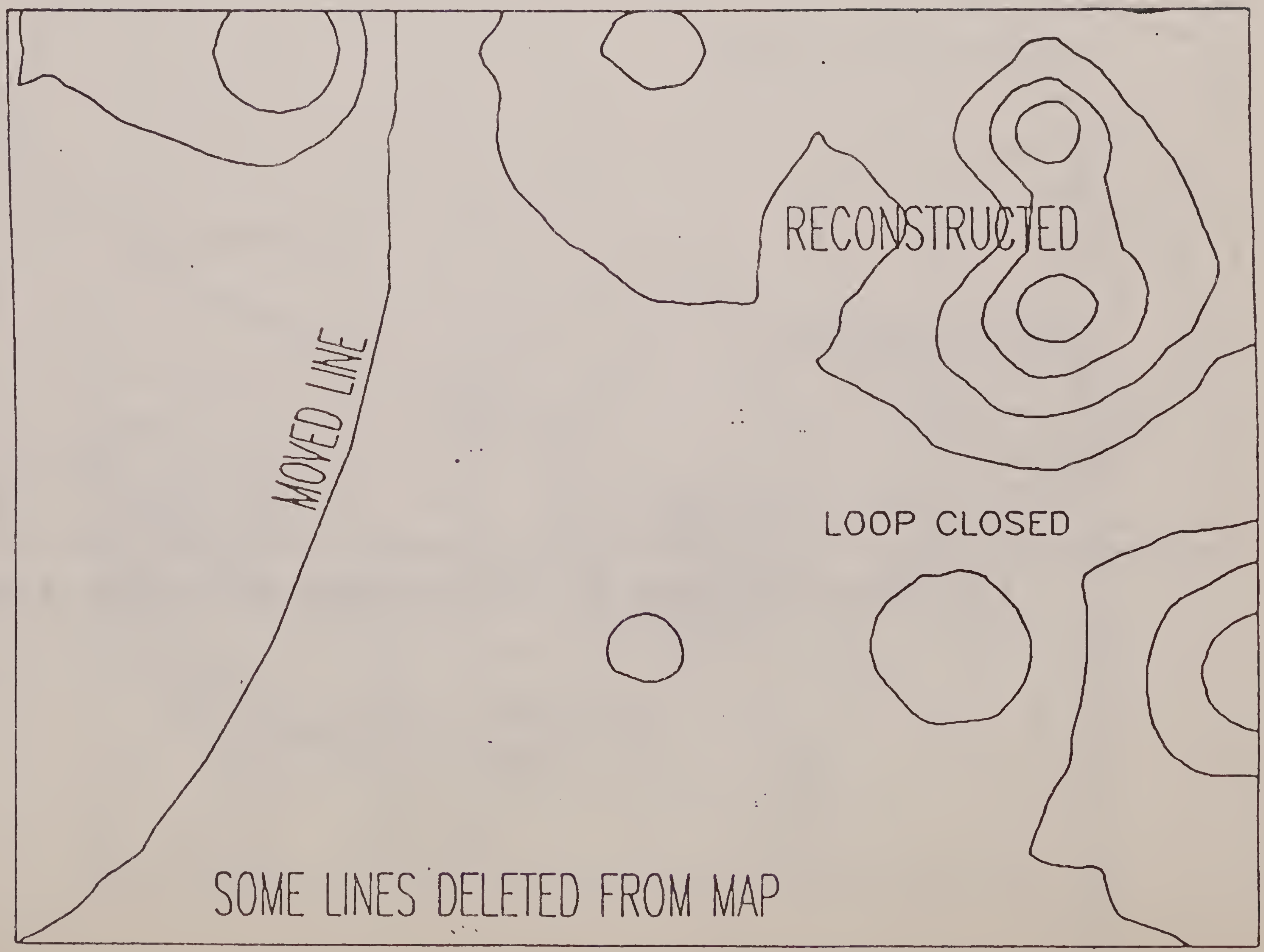


EXHIBIT D-1: RESERVED

EXHIBIT D-2: FILE FORMATS OF CASE DATA

1.0 Case Lands Data

1.16 Format

Field Name	Starting Column	Ending Column	Field Type
serial_num	1	15	alphanumeric
serial_case_pt_num	16	17	alphanumeric
record_num	18	18	integer
meridian	19	20	alphanumeric
range	21	25	alphanumeric
township	26	30	alphanumeric
section	31	33	alphanumeric
survey_type	34	34	alphanumeric
survey_num	35	39	alphanumeric
survey_suffix	40	41	alphanumeric
aliquot	42	57	alphanumeric
acres	67	74	real(8.3)
survey_note	75	75	alphanumeric
state	76	77	alphanumeric
county	78	80	integer
congress_dist	81	82	integer
blm_district	83	84	integer
resource_area	85	86	integer
resource_pl_unit	87	88	integer
admin_agency	89	96	alphanumeric

1.25 Format

Field Name	Starting Column	Ending Column	Field Type
serial_num	1	15	alphanumeric
serial_case_pt_num	16	17	alphanumeric
record_num	18	18	integer
meridian	19	20	alphanumeric
range	21	25	alphanumeric
township	26	30	alphanumeric
section	31	33	alphanumeric
survey_type	34	34	alphanumeric
survey_num	35	39	alphanumeric
survey_suffix	40	41	alphanumeric
subdivisions	42	66	alphanumeric
acres	67	74	real(8.3)
survey_note	75	75	alphanumeric
state	76	77	alphanumeric
county	78	80	integer
congress_dist	81	82	integer
blm_district	83	84	integer
resource_area	85	86	integer
resrouce_pl_unit	87	88	integer
admin_agency	89	96	alphanumeric

The case lands record type is used to link a Match Merge record with a LLD record. The meridian, township, range, section, survey_type, survey_num, and survey_suffix fields are used to search for a unique record match in the LLD file.

2.0 Case Data

A case data record is required for each case or case part. Only one case data record is permitted per case.

Field Name	Starting Column	Ending Column	Field Type
serial_num	1	15	alphanumeric
ser_case_pt_num	16	17	alphanumeric
record_num	18	18	integer
case_type	19	24	integer
doc_cat	25	26	alphanumeric
doc_id	27	34	alphanumeric
action_dt	35	42	integer
rights_in_title_1	43	45	integer
rights_in_title_2	46	48	integer

rights_in_title_3	49	51	integer
rights_in_title_4	52	54	integer
rights_in_title_5	55	57	integer
rights_in_title_6	58	60	integer
rights_in_title_7	61	63	integer
rights_in_title_8	64	66	integer
rights_in_title_9	67	69	integer
rights_in_title_10	70	72	integer
geo_name	73	92	alphanumeric
admin_agency	93	100	alphanumeric
pending_disposition	101	107	alphanumeric

3.0 Supplemental Case Data

Supplemental case data is not a required data record for a case but multiple records are permitted for one case.

Field Name	Starting Column	Ending Column	Field Type
serial_num	1	15	alphanumeric
ser_case_pt_num	16	17	alphanumeric
record_num	18	18	integer
de_num1	19	22	alphanumeric
sup_data1	23	37	integer
de_num2	38	41	integer
sup_data2	42	56	alphanumeric

4.0 Action Data

At least one action data record must exist for each case. Multiple action data records are permitted.

Field Name	Starting Column	Ending Column	Field Type
serial_num	1	15	alphanumeric
ser_case_pt_num	16	17	alphanumeric
record_num	18	18	integer
action_date	19	26	integer
action_code	27	29	integer
action_remark	30	50	alphanumeric

5.0 Name and Address

A name and address data record is required for each case or case part. Multiple name and address records are permitted.

Field Name	Starting Column	Ending Column	Field Type
serial_num	1	15	alphanumeric
ser_case_pt_num	16	17	alphanumeric
record_num	18	18	integer
name	19	48	alphanumeric
category	49	49	alpha
address	50	79	alphanumeric
city	80	94	alphanumeric
state	95	96	alpha
zip	97	105	alphanumeric
name_id_num	106	117	alphanumeric
int_rel	118	119	integer
pct_int	120	131	real(F12.2)

6.0 General Remarks

General remarks are not required for case or case parts, but if used multiple records can exist.

Field Name	Starting Column	Ending Column	Field Type
serial_num	1	15	alphanumeric
ser_case_pt_num	16	17	alphanumeric
record_num	18	18	integer
line_num	19	20	integer
general_remark	21	72	alphanumeric

EXHIBIT D-3: FILENAMES FOR CASE DATA

The following table lists the filenames for Current Status, Case Recordation, and Mining Claims data sets.

Record Type	Status		Case Recordation		
Case Lands	ST1.16	ST1.25	CR1.16	CR1.25	
	ST2.16	ST2.25	CR2.16	CR2.25	
	ST3.16	ST3.25	CR3.16	CR3.25	
	ST4.16	ST4.25	CR4.16	CR4.25	
	ST5.16	ST5.25	CR5.16	CR5.25	
	ST6.16	ST6.25	CR6.16	CR6.25	
	ST7.16	ST7.25	CR7.16	CR7.25	
	ST8.16	ST8.25	CR8.16	CR8.25	
	ST9.16	ST9.25	CR9.16	CR9.25	
	ST10.16	ST10.25	CR10.16	CR10.25	
	ST11.16	ST11.25	CR11.16	CR11.25	
	ST12.16	ST12.25	CR12.16	CR12.25	
	ST13.16	ST13.25	CR13.16	CR13.25	
	ST14.16	ST14.25	CR14.16	CR14.25	
	ST15.16	ST15.25	CR15.16	CR15.25	
	ST16.16	ST16.25	CR16.16	CR16.25	
	ST17.16	ST17.25	CR17.16	CR17.25	
	ST18.16	ST18.25	CR18.16	CR18.25	
	ST19.16	ST19.25	CR19.16	CR19.25	
	ST20.16	ST20.25	CR20.16	CR20.25	
	ST21.16	ST21.25	CR21.16	CR21.25	
Case Data	NM.TWO		CR.TWO		
Supplemental	NM.THREE		CR.THREE		MC.THREE
Action	NM.FOUR		CR.FOUR		MC.FOUR
Name & Address	NM.FIVE		CR.FIVE		
General Remarks	NM.SIX		CR.SIX		

EXHIBIT D-4: PLAT THEME DATA FILES

1.0 Transportation Data File Names

The Transportation data filenames are as follows:

CHACO-MESA.AQ1.RDS05
CHACO-CANYON-AZ3.RRT01
CHACO-CANYON-AZ3.RRT02
CHACO-CANYON-AZ3.MTT02
CHACO-MESA.AQ1.RRT01
CHACO-CANYON-AZ3.RDS26
CHACO-CANYON-AZ3.RDS27
CHACO-CANYON-AZ3.RDS28
CHACO-CANYON-AZ3.RDS29
FARMINGTON.SI2.RDS22
CHACO-CANYON-AZ3.RDS18
CHACO-CANYON-AZ3.RDS19
CHACO-CANYON-AZ3.RDS20
CHACO-CANYON-AZ3.RDS21
FARMINGTON.SI2.RDS16
FARMINGTON.SI2.RRT02
FARMINGTON.SI2.MTT01
FARMINGTON.SI2.MTT02
CHACO-CANYON-AZ3.RDS13
CHACO-CANYON-AZ3.RDS12
CHACO-CANYON-AZ3.RDS11
CHACO-CANYON-AZ3.RDS10
CHACO-CANYON-AZ3.RDS05
CHACO-CANYON-AZ3.RDS04
CHACO-CANYON-AZ3.RDS03
CHACO-MESA.AQ1.RDS04
CHACO-MESA.AQ1.MTT01
FARMINGTON.SI2.RDS14
FARMINGTON.SI2.RDS15
FARMINGTON.SI2.RDS23
FARMINGTON.SI2.RDS24
FARMINGTON.SI2.RRT01
CHACO-MESA.AQ1.RDS03
CHACO-MESA.AQ1.MTT02
DURANGO-DU3.RDS29
DURANGO-DU3.RDS28
CHACO-MESA.AQ1.RRT02
NAVAJO-RESERVOIR.AZ1.RDS03
NAVAJO-RESERVOIR.AZ1.RDS04
NAVAJO-RESERVOIR.AZ1.RDS09
NAVAJO-RESERVOIR.AZ1.RDS10
NAVAJO-RESERVOIR.AZ1.RDS11

NAVAJO-RESERVOIR.AZ1.RDS12
NAVAJO-RESERVOIR.AZ1.RDS17
NAVAJO-RESERVOIR.AZ1.RDS18
NAVAJO-RESERVOIR.AZ1.RDS19
NAVAJO-RESERVOIR.AZ1.RDS20
NAVAJO-RESERVOIR.AZ1.RDS27
NAVAJO-RESERVOIR.AZ1.RDS28
NAVAJO-RESERVOIR.AZ1.RRT01
NAVAJO-RESERVOIR.AZ1.MTT01
DURANGO-DU3.RRT02
DURANGO-DU3.MTT01
DURANGO-DU3.MTT02
NAVAJO-RESERVOIR.AZ1.RDS05
NAVAJO-RESERVOIR.AZ1.RDS06
NAVAJO-RESERVOIR.AZ1.RDS13
NAVAJO-RESERVOIR.AZ1.RDS14
DURANGO-DU3.RDS27
NAVAJO-RESERVOIR.AZ1.RDS21
NAVAJO-RESERVOIR.AZ1.RDS22
DURANGO-DU3.RRT01
NAVAJO-RESERVOIR.AZ1.RDS29
NAVAJO-RESERVOIR.AZ1.RDS30
DURANGO-DU3.RDS30
CHACO-MESA.AQ1.RDS02
NAVAJO-RESERVOIR.AZ1.MTT02

2.0 Hydrography Data File Names

The Hydrography data filenames are as follows:

CHACO-MESA.AQ1.HYS04
DURANGO-DU3.HYS30
FARMINGTON.SI2.HYS14
FARMINGTON.SI2.HYS22
CHACO-CANYON-AZ3.HYS05
FARMINGTON.SI2.HYS23
CHACO-CANYON-AZ3.HYS04
CHACO-MESA.AQ1.HYS05
CHACO-CANYON-AZ3.HYS03
CHACO-CANYON-AZ3.HYS29
CHACO-CANYON-AZ3.HYS28
CHACO-CANYON-AZ3.HYS27
CHACO-CANYON-AZ3.HYS26
FARMINGTON.SI2.HYS15
FARMINGTON.SI2.HYS16
CHACO-CANYON-AZ3.HYS21
CHACO-CANYON-AZ3.HYS20
CHACO-CANYON-AZ3.HYS19

CHACO-CANYON-AZ3.HYS18
FARMINGTON.SI2.HYS24
CHACO-CANYON-AZ3.HYS13
CHACO-CANYON-AZ3.HYS12
CHACO-CANYON-AZ3.HYS11
CHACO-CANYON-AZ3.HYS10
NAVAJO-RESERVOIR.AZ1.HYS03
NAVAJO-RESERVOIR.AZ1.HYS04
NAVAJO-RESERVOIR.AZ1.HYS09
NAVAJO-RESERVOIR.AZ1.HYS10
NAVAJO-RESERVOIR.AZ1.HYS11
NAVAJO-RESERVOIR.AZ1.HYS12
NAVAJO-RESERVOIR.AZ1.HYS17
NAVAJO-RESERVOIR.AZ1.HYS18
NAVAJO-RESERVOIR.AZ1.HYS19
NAVAJO-RESERVOIR.AZ1.HYS20
NAVAJO-RESERVOIR.AZ1.HYS27
NAVAJO-RESERVOIR.AZ1.HYS28
CHACO-MESA.AQ1.HYS03
DURANGO-DU3.HYS28
DURANGO-DU3.HYS27
NAVAJO-RESERVOIR.AZ1.HYS05
NAVAJO-RESERVOIR.AZ1.HYS06
NAVAJO-RESERVOIR.AZ1.HYS13
NAVAJO-RESERVOIR.AZ1.HYS14
NAVAJO-RESERVOIR.AZ1.HYS21
NAVAJO-RESERVOIR.AZ1.HYS22
NAVAJO-RESERVOIR.AZ1.HYS29
NAVAJO-RESERVOIR.AZ1.HYS30
DURANGO-DU3.HYS29
CHACO-MESA.AQ1.HYS02

3.0 Political Boundary File Names

The Political Boundary data filenames are as follows:

LTD.COUNTIES

EXHIBIT D-5: FILENAMES OF DEM DATA FILES

1.0 DEM Filenames

The DEM data filenames, their aliases, and their corresponding quad numbers are as follows:

Filename	Alias	Quad Number
AZTEC.SE	TURLEY	G736107
CARRACAS.CANYON		H236107

EXHIBIT D-6: PCCS FILE FORMATS

1.0 PCCS A File Format

The first 80 character record contains the header information. The record format is as follows:

Field Name	Starting Column	Ending Column	Field Type
twp_abvr	3	5	alphanumeric
twp_actual	7	10	alphanumeric
rng_abvr	13	15	alphanumeric
rng_actual	17	20	alphanumeric
pm_abvr	23	24	alphanumeric
pm_actual	26	35	alphanumeric
ad_state_cd	38	57	alphanumeric
intro_date	60	63	alphanumeric
enter_date	65	72	alphanumeric

The following 80 character records are as follows:

Field Name	Starting Column	Ending Column	Field Type
grid_no	2	7	alphanumeric
point_descriptor_1	8	11	alphanumeric
point_descriptor_2	12	22	alphanumeric
section_1	23	24	integer
section_2	25	26	integer
section_3	27	28	integer
section_4	29	30	integer
comments	31	80	alphanumeric

2.0 PCCS L File Format

The first 80 character record contains the header information. The record format is as follows:

Field Name	Starting Column	Ending Column	Field Type
twp_abvr	3	5	alphanumeric
twp_actual	7	10	alphanumeric
rng_abvr	13	15	alphanumeric
rng_actual	17	20	alphanumeric
pm_abvr	23	24	alphanumeric
pm_actual	26	35	alphanumeric
ad_state_cd	38	57	alphanumeric
intro_date	60	63	alphanumeric
enter_date	65	72	alphanumeric

The second 80 character record contains the origin information. The record format is as follows:

Field Name	Starting Column	Ending Column	Field Type
origin_header	2	7	alphanumeric
origin_latitude	11	22	real(12.4)
origin_longitude	23	35	real(13.4)
computed_x	55	64	real(10.4)
computed_y	65	74	real(10.4)

The remaining 80 character records are as follows:

Field Name	Starting Column	Ending Column	Field Type
grid_no	2	10	alphanumeric
line_segment_seq_num	14	16	integer
subdivision_line	20	22	integer
pen_control_line	46	48	integer
computed_x	55	64	real(F10.2)
computed_y	65	74	real(F10.2)

3.0 PCCS X File Format

The first 80 character record contains the header information. The record format is as follows:

Field Name	Starting Column	Ending Column	Field Type
twp_abvr	3	5	alphanumeric
twp_actual	7	10	alphanumeric
rng_abvr	13	15	alphanumeric
rng_actual	17	20	alphanumeric
pm_abvr	23	24	alphanumeric
pm_actual	26	35	alphanumeric
ad_state_cd	38	57	alphanumeric
intro_date	60	63	alphanumeric
enter_date	65	72	alphanumeric

The second 80 character record contains the origin information. The record format is as follows:

Field Name	Starting Column	Ending Column	Field Type
origin_header	2	7	alphanumeric
origin_latitude	11	22	real(12.4)
origin_longitude	23	35	real(13.4)
elevation	36	44	real(9.3)
ave_closure_err	46	48	integer
max_closure_err	50	53	integer
computed_x	55	64	real(10.4)
computed_y	65	74	real(10.4)

The rest of the X records are in the following format.

Field Name	Starting Column	Ending Column	Field Type
point_id	2	7	integer
latitude	11	22	real(12.4)
longitude	23	35	real(13.4)
elevation	36	44	real(9.3)
ave_closure_err	46	48	integer
max_closure_err	50	53	integer
computed_x	55	64	real(10.4)
computed_y	65	74	real(10.4)

EXHIBIT D-7: FD 29 INPUT FILE FORMATS

1.0 Rectangular Data File Formats

The rectangular data files will have the following file formats:

Record Number 1

Position 1	Record Number
Position 3 & 4	Meridian Number
Position 6 - 10	Township Number and Direction
Position 12 - 16	Range Number and Direction
Position 18 - 25	Point Identification Number
Position 31 & 32	Degrees of Latitude
Position 35 & 36	Minutes of Latitude
Position 39 - 44	Seconds and fractional seconds of Latitude
Position 49 - 51	Degrees of Longitude
Position 54 & 55	Minutes of Longitude
Position 58 - 63	Seconds and fractional seconds of Longitude
Position 69 - 74	Average elevation of project area in feet and tenths and hundredths of a foot

Record Number 2

Position 1	Record Number
Position 3 & 4	Meridian Number
Position 6 - 10	Township Number and Direction
Position 12 - 16	Range Number and Direction
Position 18 - 25	Point Identification Number
Position 30 - 34	Distances in chains and tenths, hundredths and thousandths of a chain
Position 39	Bearing Direction
Position 43 & 44	Degrees of the Bearing
Position 49 & 50	Minutes of the Bearing
Position 55 & 56	Seconds of the Bearing

2.0 Metes and Bounds Data File Formats

The Metes and Bounds Input File format is as follows:

Position 1	Record Number
Position 5 & 6	Direction of the Bearing
Position 9 & 10	Degrees
Position 12 & 13	Minutes
Position 15 - 18	Seconds and tenths of seconds
Position 20 - 24	Distance describe in chains
Position 26 - 31	First call description i.e., Point of beginning, along a line, or to a corner
Position 33 - 36	Description of the corner call i.e., NW, NE, SW, SE, S1/4, W1/4, N1/4, S1/4 corners
Position 39	Description of the line call i.e., N, S, E, W line
Position 41 & 42	Description of the first aliquot part call i.e., NW, NE, SW, SE quarters
Position 46 & 47	Description of the second aliquot part call i.e., NW, NE, SW, SE quarters
Position 50 & 51	Description of the Section call
Position 54 & 55	Second call description i.e., to a corner
Position 57 & 58	Description of second corner call
Position 60 & 61	Description of first aliquot part for the second call i.e., NW, NE, SE, SW quarter
Position 63 & 64	Description of second aliquot part for the second call i.e., NW, NE, SE, SW quarters
Position 66 & 67	Description of the section for the second call

Record Number 1	Identified the Point of Beginning for the description.
Record Number 2	Identifies a boundary line call that the descriptions shall traverse along this line.

Record Number 3	Identifies a traverse angle point with no description calls.
Record Number 4	Identifies a corner call that the description shall traverse to this corner.
Record Number 5	Identifies a boundary line call that the description shall traverse to the line.
Record Number 6	Identifies a boundary line and corner call that the description shall traverse along this boundary line to a corner.
Record Number 7	Identifies the closing point for the description.

3.0 Sample Metes and Bounds Input File

A sample Metes and Bounds input data file has been provided, this is only a sample and does not represent the actual input for the functional demonstration.

```
1                        POB    SW               21
2   NE  00 52 27.5 10.09 ALONG       W  SW       21
3   NE  64 25 23.7 22.24
3   NE  45 44 03   15.13
3   NE  01 00 13.2 10.12
3   NW  25 03 48.6 22.62
4   NE  45 43 00   28.50  TO    N1/4             21
3   NE  72 40 05.2 31.44
3   SE  88 33 08.7  9.94
5   SE  61 44 42   21.85  TO          N NW       22
3   SE  61 44 56.3 45.79
4   SE  43 15 20   28.48  TO    W1/4             22
6   S                     ALONG       E SW       22   TO SE
22
3   SW  45 41 02   42.53
3   SW  01 07 46.8 30.43
4   SW  57 15 06   35.50  TO    SW      SW   SW  27
6   W                     ALONG       S SW   SW  27   TO SW
27
6   W                     ALONG       S SE   SE  28   TO SW SE SE
28
3   NW  43 06 54   28.49
3   NE  01 09 40.7 40.51
3   NW  43 08 43.6 13.24
3   NW  88 29 15.1 19.89
7   NW  43 01 20   15.00  POB
```

The cooresponding Metes and Bounds text description for the above input file is as follows. This text is provided for additional information only. The offeror will not be responsible for inputting a file of this format.

Beginning at the Southwest Corner of Section 21, T22N, R6W NM.;

Thence N 0 52 27.5 E, 10.09 chains along West line of the SW 1/4 of Section 21;

Thence N 64 25 23.7 E, 22.24 chains;

Thence N 45 44 03 E, 15.13 chains;

Thence N 1 00 13.2 E, 10.12 chains;

Thence N 25 03 48.6 W, 22.62 chains;

Thence N 45 43 00 E, 28.50 chains to the N 1/4 Corner of Section 21;

Thence N 72 40 05.2 E, 31.44 chains;

Thence S 88 33 08.7 E, 9.94 chains;

Thence S 61 44 42 E, 21.85 chains to the North Line of the NW 1/4 of Section 22;

Thence S 61 44 56.3 E, 45.79 chains;

Thence S 43 15 20 E, 28.48 chains to the W 1/4 Corner of Section 22;

Thence Southerly along the East Line of the SW 1/4 of Section 22 to the Southeast Corner of said Section 22;

Thence S 45 41 02 W, 42.53 chains;

Thence S 1 07 46.8 W, 30.43 chains;

Thence S 57 15 06 W, 35.50 chains to the SW Corner of the SW 1/4 of the SW 1/4 of Section 27;

Thence Westerly along the South Line of the SW 1/4 SW 1/4 to the SW Corner of Section 27;

Thence Westerly along the South Line of the SE 1/4 SE 1/4 of Section 28 to the SW Corner of the SE 1/4 SE 1/4 of said Section 28;

Thence N 43 06 54 W, 28.49 chains;

Thence N 1 09 40.7 E, 40.51 chains;

Thence N 43 08 43.6 W, 13.24 chains;

Thence N 88 29 15.1 W, 19.89 chains;

Thence N 43 01 20 W, 15.00 chains to the Point of Beginning.

4.0 Sample Rectangular Input Data File

A sample rectangular input data file has been provided, this is only a sample and does not represent the actual input for the functional demonstration.

```
1 23 0210N 0070W 01363106       36   5  164350     107  31   84440      680000
1 23 0220N 0070W 01363106       36  10  327020     107  31   10790      680000
1 23 0220N 0060W 01363106       36  10  263160     107  24  378260      680000
1 23 0210N 0060W 01363106       36   5   97370     107  24  441170      680000

2 23 0210N 0070W 01363106        0    0    0     0     0
2 23 0220N 0070W 3600CL31    40390    1    1    10     0
2 23 0220N 0070W 36253031    40390    1    1    10     0
2 23 0220N 0070W 2500CL30    40390    1    1    10     0
2 23 0220N 0070W 25241930    40390    1    1    10     0
2 23 0220N 0070W 2400CL19    40390    1    1    10     0
2 23 0220N 0070W 24131819    40390    1    1    10     0
2 23 0220N 0070W 1300CL18    40390    1    1    10     0
2 23 0220N 0070W 13120718    40390    1    1    10     0
2 23 0220N 0070W 1200CL07    40390    1    1    10     0
2 23 0220N 0070W 12010607    40390    1    1    10     0
2 23 0220N 0070W 0100CL06    40390    1    1    10     0
2 23 0220N 0070W 01363106    40340    1    0     1     0

2 23 0220N 0070W 01363106        0    0    0     0     0
2 23 0220N 0060W 06CL0031    39910    2   88    35     0
2 23 0220N 0060W 06313205    39690    2   88    52     0
2 23 0220N 0060W 05CL0032    39690    2   88    52     0
2 23 0220N 0060W 05323304    39690    2   88    52     0
2 23 0220N 0060W 04CL0033    39690    2   88    52     0
2 23 0220N 0060W 04333403    39690    2   88    52     0
2 23 0220N 0060W 03CL0034    39690    2   88    52     0
2 23 0220N 0060W 03343502    39690    2   88    52     0
2 23 0220N 0060W 02CL0035    39690    2   88    52     0
2 23 0220N 0060W 02353601    39690    2   88    52     0
2 23 0220N 0060W 01CL0036    39690    2   88    52     0
2 23 0220N 0060W 01363106    39690    2   88    52     0
```

EXHIBIT D-8: MOSS DATA FILE FORMATS

PAGE 1

DATA FILE DOCUMENTATION FOR MOSS/MAPS

PERMANENT FILES

MAP NAMES LIST (.DT) 2
HEADER RECORDS (.HD TYPE 1,2,3,5,6,7,8,11,12,13) 3
SUBJECT RECORDS FOR VECTOR MAPS (TYPE 1,2,3,5,11,12,13) 4
FEATURE RECORDS FOR VECTOR MAPS 5
COORDINATE RECORDS FOR VECTOR MAPS 6
MULTIPLE ATTRIBUTE (.AT) FILES OF VECTOR MAPS 6-7
CELL MAPS (.CB TYPE 6, .CD .CV .AD TYPE 7, .CC TYPE 8) 8
IMPORT/EXPORT FORMAT 9

FILE NAME: MAP NAMES FILE. THIS FILE IDENTIFIED BY ITS .DT SUFFIX. IT CONTAINS A SERIES OF MAP NAMES ASSOCIATED WITH MASTER OR WORK MAPS WHICH CAN BE USED TO ORGANIZE THE MAPS WITHIN DIRECTORIES SO A USER CAN LOCATE THEM EASIER.

RECORD TYPE: 128 WORD RECORDS WITH THE FIRST RECORD CONTAINING 7 MAPS AND ALL SUBSEQUENT RECORDS CONTAINING 8 MAPS *
MAP RECORDS ARE 2 THROUGH N (N = # OF MAP RECORDS)

WORD #	BYTE #	# BYTES	TYPE	DESCRIPTION
1-8	1-16	16	CHAR	NAME - Blank filled RIGHT
9	17	1	INTE	# of bits PER LOGICAL RECORD (type 6-8)
9	18	1	INTE	STATUS - 1-exposed 2-protected 0-deleted 3-archived
10	19-20	2	INTE	TYPE 1-point 2-line 3-polygon 4- 5-elevation point 6-dichotomous cell 7-discrete cell 8-continuous cell 9- 10-text 11-POINT 3-D 12-LINE 3-D 13-POLYGON 3-D 15-Component 14-Profile 16-write 17-READ 18-display output 19-display input
11	21-22			RESERVED
12	23-24	2	INTE	# of ATTRIBUTES - TYPE 1-13
13	25-26	2	INTE	# of ROWS - Type 6-9 # of ITEMS - Type 1-5, 11-13
14	27-28	2	INTE	# of COLUMNS - Type 6-8 RESERVED ALL OTHER TYPES
15	29-30	2	INTE	# of BYTES in attribute (TYPE 6-8)
16	31-32		INTE	RESERVED

*This file is stored in alphabetic order of the first sixteen bytes. THE FIRST RECORD IS ALL NULL EXCEPT WORD 16 WHICH CONTAINS THE NUMBER OF RECORDS IN THE FILE. # OF MAPS IS WORD 16 MINUS ONE.

FILE NAME: HEADER RECORDS FOR VECTOR AND RASTER MAPS. THESE INCLUDE TYPES 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, AND 13 (POINT, LINE, POLYGON, AND CELL MAPS).
RECORD TYPE: CELL FILES WITH .HD SUFFIX AND FIRST TWO RECORDS OF VECTOR FILES

WORD #	BYTE #	# BYTES	TYPE	DESCRIPTION
1	1-2	2		RESERVED
2-11	3-22	20	CHAR	NAME OF DIGITIZING SYSTEM
12-15	23-30	8	CHAR	DATE OF ENTRY TO MOSS
16-19	31-38	8	CHAR	STUDY AREA NAME
20-49	39-98	60	CHAR	MAP DESCRIPTION
50	99-100	2	I*2	MAP ORIGIN - HOW CREATED
51-52	101-104	4	CHAR	YEAR OF SOURCE MAP
53-57	105-114	10	CHAR	COORDINATE PROJECTION DESCRIPTION
58-59	115-118	4	I*4	NUMBER OF 128 WORD RECORDS IN FILE
60	119-120	2	INTE	# OF ROWS-CELL MAPS
61	121-122	2	INTE	# OF COLUMNS-CELL MAPS
62	123-124	2	INTE	MOSS DATA TYPE
63	125-126	2	INTE	# OF FEATURES
64	127-128	2	I*2	RESERVED(VALUE IS ONE)
65	129-130	2	INTE	ESTIMATED # OF SUBJECTS(UNUSED FOR CELL)
66	131-132	2		RESERVED(VALUE IS ZERO)
67	133-134	2	INTE	ACTUAL # OF SUBJECTS
68-69	135-138	4	REAL	MINIMUM X OF MBR(WEST)
70-71	139-142	4	REAL	MAXIMUM X OF MBR(EAST)
72-73	143-146	4	REAL	MINIMUM Y OF MBR(SOUTH)
74-75	147-150	4	REAL	MAXIMUM Y OF MBR(NORTH)
76	151-152	2	INTE	MULTIPLE ATTRIBUTES FILE(.AT) PRESENCE
77	153-154	2	CHAR	UNITS OF VECTOR MAP F-FEET M-METERS
78-79	155-158	4	REAL	ACRES PER CELL
80-81	159-162	4	REAL	HEIGHT OF CELL IN METERS
82-83	163-166	4	REAL	WIDTH OF CELL IN METERS
84-85	167-170	4	REAL	NUMBER OF SET BITS TYPE 6(DICHOTOMOUS)
86-87	171-174	4		RESERVED
88-89	175-178	4	REAL	MINIMUM CELL VALUE TYPE 8 (CONTINUOUS)
90-91	179-182	4	REAL	MAXIMUM CELL VALUE TYPE 8 (CONTINUOUS)
92-119	183-238	56		RESERVED
120	239-240	2	INT	FONT # ZERO IF NOT FONT ASSIGNED
121-168	241-336	96		RESERVED
169-176	337-352	16	INTE	POINTER & LAST 7 COMMAND NUMBERS
177-192	353-384	32		SAME AS 16 WORDS OF .DT RECORD FOR MAP
193-256	385-512	128		PROJECTION INFORMATION (-1 IF NONE ASSIGN 193-PROJECTION NUMBER (0-20) 194-ZONE 195-UNITS 0-RADIANS 1-FEET 2-METERS 3-SECONDS 4-DEGREES 196-ELLIPSE TYPE (0-19) 197-256 15 DOUBLE PRECISION PARAMETERS

FILE NAME: SUBJECT RECORDS FOR VECTOR MAPS. THESE INCLUDE TYPES 1, 2, 3, 5, 11, 12, AND 13 (POINT, LINE, AND POLYGON MAPS). ALL TYPES CONTAIN 128 WORD RECORDS. THE LAYOUT FOR THESE FILES IS TWO HEADER RECORDS, SUBJECT RECORDS (NUMBER ESTIMATED BY USER SO SOME MAY BE EMPTY), AND A SEQUENCE OF FEATURE, ISLAND, AND COORDINATE RECORDS FOR EVERY ITEM IN THE MAP. THE HEADER RECORDS ARE IDENTICAL IN FORMAT TO THE .HD RECORD FORMAT FOR CELL MAPS OUTLINED ABOVE.

RECORD TYPE: SUBJECT RECORDS...RECORD LENGTH = 2 + ESTIMATED # OF SUBJECTS
BEGIN LOCATION = RECORD 3

WORD #	BYTE #	# BYTES	TYPE	DESCRIPTION
1-15	1-30	30	CHAR	ALPHA-NUMERIC SUBJECT DESCRIPTOR
16	31-32	2		RESERVED
17	33-34	2	INTE	# OF FEATURES WITH THIS SUBJECT
18-34	39-68	30		RESERVED
35-36	69-72	4	I*4	POINTER TO FIRST FEATURE RECORD OF LINKED LIST OF SUBJECTS OF THIS TYPE
37-128	73-256	184		*RESERVED IF NOT FONT ASSIGNED BY SUBJECT
19	37-38	2	INTE	NUMBER OF CROSS SHADINGS OF POLYGONS
20	39-40	2	INTE	TABLE NUMBER FOR LINE & POLYGON SYMBOL NUMBER FOR POINT(FONT IN 120 OF HEADER)
21	41-42	2	INTE	STROKE WIDTH IN INCHES
22-23	43-46	4	REAL	SPACING IN METERS BETWEEN LINES FOR POLYGON WIDTH OF SYMBOL FOR POINT AND LINE
24-25	47-50	4	REAL	ROTATION IN RADIANS OF SHADE LINES FOR POLYGON HEIGHT OF SYMBOL FOR POINT AND LINE
26	51-52	2	INTE	COLOR INDEX NUMBER
27-128	53-256	204		*RESERVED IF POINT OR LINE DATA OR IF WORD 19 = 1 FOR POLYGON DATA
27	53-54	2	INTE	TABLE NUMBER FOR POLYGON
28	55-56	2	INTE	STROKE WIDTH IN INCHES
29-30	57-60	4	REAL	SPACING IN METERS BETWEEN LINES FOR POLYGON
31-32	61-64	4	REAL	ROTATION IN RADIANS OF SHADE LINES FOR POLYGON
33	65-66	2	INTE	COLOR INDEX NUMBER
34	67-68	2		RESERVED
35-36	69-72	4	I*4	POINTER TO FIRST FEATURE RECORD OF LINKED LIST OF SUBJECTS OF THIS TYPE
37-128	73-256	84		RESERVED

PAGE 5

FILE NAME: FEATURE RECORDS FOR VECTOR MAPS. THESE INCLUDE TYPES 1, 2, 3, 5, 11, 12, AND 13 (POINT, LINE, AND POLYGON MAPS).
RECORD TYPE: FEATURE RECORD
BEGIN LOCATION = 2 + ESTIMATED # OF SUBJECTS

WORD #	BYTE #	# BYTES	TYPE	DESCRIPTION
1-2	1-4	4	I*4	POINTER TO NEXT FEATURE RECORD
3-4	5-8	4	I*4	POINTER TO NEXT FEATURE WITH SAME SUBJECT
5	9-10	2	INTE	FEATURE SEQUENCE NUMBER
6	11-12	2	INTE	FEATURE TYPE 1,11-POINT 2,12-LINE 3,13-PO
7-8	13-16	4	REAL	POINT-RESERVED LINE-LENGTH POLYGON-AREA
9-10	17-20	4	REAL	POINT,LINE-RESERVED POLYGON-PERIMETER TYPE 5-ELEVATION IN WORD 10
11-12	21-24	4	REAL	POINT RESERVED POLYGON,LINE-X CENTROID
13-14	25-28	4	REAL	POINT,LINE-RESERVED POLYGON-Y CENTROID
15-16	29-32	4	REAL	MINIMUM X OF MBR (WEST)
17-18	33-36	4	REAL	MAXIMUM X OF MBR (EAST)
19-20	37-40	4	REAL	MINIMUM Y OF MBR (SOUTH)
21-22	41-44	4	REAL	MAXIMUM Y OF MBR (NORTH)
23	45-46	2	INTE	# OF RECORDS FOR FEATURE
24	47-48	2	INTE	RECORD # OF SUBJECT RECORD FOR FEATURE
25	49-50	2	INTE	# OF COORDINATE PAIRS IN NEXT RECORDS
26	51-52	2	INTE	POINT,LINE-RESERVED POLYGON-# OF ISLAND FLAGS
27-45	53-90	38	INTE	FONT ASSIGNMENTS AS FOLLOWS POINT,LINE IF FONT ASSIGNED BY FEATURE 27 - SYMBOL NUMBER 28 - STROKE WIDTH IN INCHES 29 - COLOR NUMBER 30-31-WIDTH OF SYMBOL 32-33-HEIGHT OF SYMBOL POLYGON LINE ASSIGNMENTS 34 - LINE FONT NUMBER 35 - STROKE WIDTH IN INCHES 36 - COLOR 37-38-WIDTH OF LINE 39-40-HEIGHT OF LINE 41-45 RESERVED
46-125	91-250	160	INTE	POINT, LINE: RESERVED POLYGON: FIRST 80 ISLAND POINTERS
126	251-252	2		RESERVED
127-128	253-256	4	REAL	SCALE FACTOR FOR COORDINATES

FILE NAME: ISLAND FLAGS RECORD FOR VECTOR MAPS. THESE INCLUDE TYPES 3 AND 13 WHICH ARE POLYGON MAPS.
RECORD TYPE: ISLAND FLAGS RECORD. ONLY USED WHEN # OF ISLANDS IS GREATER THAN 80. THIS RECORD FOLLOWS POLYGON FEATURE RECORD

WORD #	BYTE #	# BYTES	TYPE	DESCRIPTION
1-128	1-256	256	INTE	POINTER TO COORDINATE PAIR NUMBER WHICH BEGINS AN ISLAND

FILE NAME: COORDINATE RECORDS FOR VECTOR MAPS. THESE INCLUDE TYPES 1, 2, 3, 11, 12, AND 13 (POINT, LINE, AND POLYGON MAPS).
RECORD TYPE: COORDINATE RECORDS...FOLLOWS FEATURE AND ISLAND FLAG RECORDS.

WORD #	BYTE #	# BYTES	TYPE	DESCRIPTION
1-128	1-256	256	I*4	X AND Y COORDINATE PAIRS TO CONVERT TO A REAL VALUE, DIVIDE BY SCALE FACTOR IN WORDS 127 & 128

FILE NAME: MULTIPLE ATTRIBUTE FILE ASSOCIATED WITH VECTOR MAPS. THESE TYPES INCLUDE 1, 2, 3, 5, 11, 12, AND 13 (POINT, LINE, AND POLYGON MAPS). THESE FILES ARE NAMED THE SAME AS THE ASSOCIATED VECTOR MAP EXCEPT A .AT SUFFIX IS ADDED TO THE NAME. THIS FILE'S PRESENCE IS INDICATED BY WORD 76 OF RECORD ONE IN THE MAP HEADER. THE .AT HEADER RECORD IS FOLLOWED BY ATTRIBUTE RECORDS 2-202, FOLLOWED BY RECORD 203 WHICH IS RESERVED, WHICH IS FOLLOWED BY THE ATTRIBUTE DATA RECORDS.
RECORD TYPE: ATTRIBUTE HEADER RECORD RECORD ONE OF .AT

WORD #	BYTE #	# BYTES	TYPE	DESCRIPTION
1	1-2	2	INTE	# OF ATTRIBUTES (1-200)
2	3-4	2	INTE	# OF FEATURES IN MAP
3-128	5-256	252		RESERVED

FILE NAME: MULTIPLE ATTRIBUTE FILE ASSOCIATED WITH VECTOR MAPS. THESE TYPES INCLUDE 1, 2, 3, 5, 11, 12, AND 13 (POINT, LINE, AND POLYGON MAPS).
RECORD TYPE: ATTRIBUTE RECORD RECORD 2-202 OF .AT

WORD #	BYTE #	# BYTES	TYPE	DESCRIPTION
1	1-2	2	INTE	ATTRIBUTE ID...A SEQUENCE #
2-11	3-22	20	CHAR	ATTRIBUTE KEY...10 CHARACTERS RIGHT JUSTIFIED ONE CHARACTER PER WORD
12-83	23-166	144	CHAR	ATTRIBUTE DESCRIPTION...72 CHARACTERS RIGHT JUSTIFIED ONE CHARACTER PER WORD
84	167-168	2	INTE	ATTRIBUTE TYPE...1-INTEGER 2-REAL 3-CHARACTER
85	169-170	2	INTE	ATTRIBUTE LENGTH IN WORDS INTEGER-1 REAL-2 CHARACTER-3
86	171-172	2	INTE	FIRST RECORD IN FILE CONTAINING ATTRIBUTE DATA FOR THIS ATTRIBUTE
87	173-174	2	INTE	# OF RECORDS REQUIRED TO STORE THE ATTRIBUTE DATA FOR THIS ATTRIBUTE FORMULA USED IS: (INT((RECORD1,WORD2)**-1)/(128/WORD85))+1
88-128	175-256	82		RESERVED

FILE NAME: TYPE 1,2,3,5,11,12,13 POINT LINE POLYGON VECTOR MAPS MULTIPLE ATTRIBUTE FILE.

RECORD TYPE: ATTRIBUTE RECORD RECORD 203 OF .AT

WORD #	BYTE #	# BYTES	TYPE	DESCRIPTION
1-128	1-256	256		RESERVED

FILE NAME: TYPE 1,2,3,5,11,12,13 POINT LINE POLYGON VECTOR MAPS MULTIPLE ATTRIBUTE FILE. THE ATTRIBUTE DATA VALUES FOR EACH FEATURE ARE STORED AND ACCESSED IN THE SAME SEQUENCE AS THE FEATURES. I.E. THE ATTRIBUTE DATA FOR THE FIFTH FEATURE IS IN THE FIFTH ATTRIBUTE DATA SLOT. ALL ATTRIBUTE DATA FOR ATTRIBUTE ONE IS FOLLOWED BY ALL ATTRIBUTE DATA FOR ATTRIBUTE TWO ETC. ONCE THE ATTRIBUTE FILE IS BUILT ADDITIONAL FEATURES CAN NOT BE ADDED, HOWEVER MORE ATTRIBUTES CAN BE ADDED.

RECORD TYPE: ATTRIBUTE DATA RECORDS RECORD 204-N OF .AT

WORD #	BYTE #	# BYTES	TYPE	DESCRIPTION

IF WORD 84 OF ATTRIBUTE RECORD IS 1-INTEGER
THE INTEGER ATTRIBUTE DATA IS STORED ONE VALUE PER WORD. THE NUMBER OF VALUES PER RECORD IS 128. THE NUMBER OF RECORDS TO STORE THE DATA IS THE NUMBER OF FEATURES/128. THE REMAINDER OF THE LAST RECORD IS UNDEFINED.

IF WORD 84 OF ATTRIBUTE RECORD IS 2-REAL
THE REAL ATTRIBUTE DATA IS STORED ONE VALUE EVERY TWO WORDS. THE NUMBER OF VALUES PER RECORD IS 64. THE NUMBER OF RECORDS TO STORE THE DATA IS THE NUMBER OF FEATURES/64. THE REMAINDER OF THE LAST RECORD IS UNDEFINED.

IF WORD 84 OF ATTRIBUTE RECORD IS 3-CHARACTER
THE CHARACTER ATTRIBUTE DATA IS STORED ONE CHARACTER RIGHT JUSTIFIED PER WORD. THE CHARACTER FIELD IS NULL FILLED. THE CHARACTER FIELD DOES NOT CROSS RECORD BOUNDS AND AS A RESULT THE ENDS OF THE RECORDS ARE UNDEFINED AND THE END OF THE LAST RECORD IS UNDEFINED. THE RECORD WOULD ACCOMMODATE 12 TEN CHARACTER FIELDS, 6 TWENTY CHARACTER FIELDS, 1 EIGHTY CHARACTER FIELD, ETC.

FILE NAME: TYPE 6 DICHOTOMOUS CELL MAPS. TYPE 6 HAS .HD AND .CB FILES
RECORD TYPE: .CB

WORD NUMBER	BYTE NUMBER	NO. OF BYTES	TYPE	DESCRIPTION
1-N	1-N	N	INTE	CELL VALUES THE LENGTH OF THE CELL IS 1 BIT. THERE IS NO .CV OR .AD FILES ONLY A .HD FILE TO ACCOMPANY THIS .CB FILE.

FILE NAME: TYPE 7 DISCRETE CELL MAPS TYPE 7 HAS .HD .CD .CV AND POSSIBLE .AD
RECORD TYPE: .CD

WORD NUMBER	BYTE NUMBER	NO. OF BYTES	TYPE	DESCRIPTION
1-N	1-N	N	INTE	CELL VALUES THE LENGTH OF THE CELL IS 1,2,4,8,OR 16 BITS DEPENDING ON THE # OF ATTRIBUTES IN THE FILE. THE # OF BITS IS IS IN WORD 9 OF THE .DT AND THE # OF ATTRIBUTES IS IN WORD 12.

FILE NAME: TYPE 7 DISCRETE CELL MAPS VALUE/COUNT
RECORD TYPE: .CV

WORD NUMBER	BYTE NUMBER	NO. OF BYTES	TYPE	DESCRIPTION
1-2	1-4	4	REAL	VALUE - the value of the attribute for discrete cell maps. Items with the same attribute point at the same .CV record.
3-4	5-8	4	REAL	COUNT - the number of items pointing at this .CV record.

FILE NAME: TYPE 7 DISCRETE CELL MAPS ATTRIBUTE DESCRIPTOR
RECORD TYPE: .AD IF WORD 15 IS 0 THIS FILE DOES NOT EXIST

WORD NUMBER	BYTE NUMBER	NO. OF BYTES	TYPE	DESCRIPTION
1-32	1-64	64	CHAR	ALPHANUMERIC DESCRIPTOR OF ATTRIBUTE. THE LENGTH IS THE VALUE IN WORD 15 OF THE .DT FILE IF THIS VALUE IS 0 THEN THIS FILE DOES NOT EXIST. THIS VALUE IS 0, 16, 32, OR 64 FOR AN EXISTING FILE.

FILE NAME: TYPE 8 CONTINUOUS CELL MAPS. TYPE 8 HAS .HD AND .CC FILES
RECORD TYPE: .CC

WORD NUMBER	BYTE NUMBER	NO. OF BYTES	TYPE	DESCRIPTION
1-N	1-N	N	INTE	CELL VALUES THE LENGTH OF THE CELL IS 16 OR 32 BITS. THERE
IS				.CV OR .AD FILES ONLY A .HD
FILE				TO ACCOMPANY THIS .CC FILE.

PAGE 9

FILE TYPE: STANDARD MOSS INPUT
FILE LENGTH: VARIABLE

RECORD TYPE: HEADER (REPEATING SERIES OF HEADER RECORDS PRECEEDING ASSOCIATED COORDINATE PAIR DATA) (READ IN I5,5X,15A2,5X,I5 FORMAT)
RECORD LENGTH: 56 CHARACTERS
RECORD POSITION: (1) BEFORE START OF ASSOCIATED COORDINATE DATA

*WORD NUMBER	BYTE NUMBER	FIELD LENGTH	FIELD TYPE	FIELD DESCRIPTION
1-3	1-5	5	CHAR	Item Number(NEGATIVE IF THE COORDINATES ARE LON/LAT)
3-8	6-15	10	CHAR	Blanks
8-23	16-45	30	CHAR	Attribute Name
23-25	46-50	5	CHAR	Blanks
26-28	51-55	5	CHAR	Number of coord. pairs
28	56	1	CHAR	ASCII NEW LINE CHARACTER

RECORD TYPE: COORDINATE PAIRS (SERIES OF X,Y COORDINATES FOLLOWING HEADER RECORD)
RECORD LENGTH: 23 CHARACTERS
RECORD POSITION: AFTER HEADER RECORD (NUMBER OF COORDINATE RECORDS EQUALS THE VALUE INDICATED BY BYTES 51-55 IN THE HEADER RECORD) (READ IN 2F11.2 FORMAT)

*WORD NUMBER	BYTE NUMBER	FIELD LENGTH	FIELD TYPE	FIELD DESCRIPTION
1-6	1-11	11	CHAR	X Coordinate
6-11	12-22	11	CHAR	Y Coordinate
12	23	1	CHAR	ASCII NEW LINE CHARACTER

IF COORDINATES ARE LONGITUDE/LATITUDE (READ IN 2F10.5,I2 FORMAT)

1-5	1-10	10	CHAR	LONGITUDE
6-10	11-20	10	CHAR	LATITUDE
11	21-22	2	CHAR	FLAG 0-NORMAL 1-INDICATES

				FIRST POINT OF ISLAND POLYGON
12	23	1	CHAR	ASCII NEW LINE CHARACTER

*NOTE: Assumes 2 Alpha characters (2 bytes) to one word.

EXHIBIT D-9: ADS DATA FILE FORMATS

```
06/05/88                        ADS Revision 8.00
                             Data File Specifications


FILENAME:  ADS.<mapname>

           Contents:     Scale, map type, and regression information.
           Data format:  Direct access, 90 characters per record.

FORMATS:   Format for latitude/longitude maps (map types 1, 2, and 6)


Record
Number    Record Format and Description
______    _________________________________________________________

  1       ( 6I5 ), where 6I5 is a line pointer to:

                  scale data records              <RecScl>
                  map type record                 <RecTyp>
                  longitude record                <RecLon>
                  latitude record                 <RecLat>
                  registration point records      <RecReg>
                  revision records                <RecRev>

          Example:

               REC #1:  ....I....I....I....I....I....I
                            2   10   11   12   13   23

          Note:Map Type Record = Scale Data Records + 3 +
                                 ( (Number of Parameters + 4) / 5 ) + 1 = 9.

               Since the maximum number of projection parameters from the
               USGS projection package is currently 15.

RecScl    ( 20X, F10.0, 17X, I3 ), where the line appears as:

      REC #RecScl: ....I....I....I....I....I....I....I....I....I....I
                   ACTUAL MAP SCALE  1:nnnnnnnnn. PROJECTION CODE=nnn

RecScl+1 ( 31X, F10.0, 6X, F10.0 ), where the line appears as:

      REC #RecScl+1:
            ....I....I....I....I....I....I....I....I....I....I....I..
            CALCULATED ORIG MAP SCALE  X=1:nnnnnnnnn.  Y=1:nnnnnnnnn.

RecScl+2 ( 14X, F20.2 ), where the line appears as:

     REC #RecScl+2:  ....I....I....I....I....I....I....
                       MAP ACRES =   nnnnnnnnnnnnnnnnnn.nn

         Note:  RecScl+2+I, where I = 1 to [(<number of parameters>+4)/5];
                or, as currently defined, I = 1 to 3 parameter lines
                (1 to 5 parameters allowed per line with a current maximum
                of 15 parameters).

                Thus: Read RecScl+K, while K = 1 to N (with N<=3).
```

```
ADS Revision 8.00
Data File Specifications
Page 2.

Record
Number    Record Format and Description
-------   ----------------------------------------------------------


RecScl+K  ( 10X, 5F15.4 ), where each parameter line appears as:

          REC #RecScl+K:

...I....I....I....I....I....I....I....I....I....I....I....I....I....I
       PROJ PARM nnnnnnnnnn.nnnnddddddddddd.ddddnnnnnnnnnnn.nnnnddddddddddd.dddd
     + ....I....I....I....I
       nnnnnnnnnn.nnnn

RecScl+K+1 ( 10X, I5, 10X, I5 ), where the K+1 parameter line appears as:

          REC #RecScl+K+1:
               ....I....I....I....I....I....I
               UTM ZONE =nnnnnPROJ UNIT=nnnnn

RecTyp    ( 9X, I1, 1X, A20, 16X, I3 ), where the map type line appears as:

          REC #RecTyp:
             ....I....I....I....I....I....I....I....I....I....I
             MAP TYPE=n=AAAAAAAAAAAAAAAAAAAA NO CONT POINTS=nnn (50 max)
                                        where NCtlPt = ncp

RecLon    ( 15X, F8.2 ), where the longitude line appears as:

          REC #RecLon:  ....I....I....I....I....I
                        LONGITUDE R**2=nnnnn.nn

RecLat    ( 15X, F8.2 ), where the latitude line appears as:

          REC #RecLon:  ....I....I....I....I....I
                        LATITUDE  R**2=nnnnn.nn

RecReg    ( 89X,  ), where this is a text line only (column titles).

                Then: Read RecReg+K, while K = 1 to (NCtlPt*2), 2
                      where NCtlPt = number of control points

RecReg+K   (I4, 3X, 2F8.3, 17X, I4, 1X, I2, X, F5.2, 1X, F19.8 )
RecReg+K+1 (                40X, I4, 1X, I2, X, F5.2, 1X, F19.8 )

                 Where each pair of lines appears as:

           REC #RecReg+K and #RecReg+K+1
CTL-PNT    X        Y                      GEODETIC    PROJECTED
....I....I....I....I....I....I....I....I....I....I....I....I....I....I ..
   1   xxxx.xxxyyyy.yyy      LONG(EAST) dddd mm ss.ss  pppppppppp.pppppppp
                             LAT(NORTH) dddd mm ss.ss  pppppppppp.pppppppp
```

```
Record
Number    Record Format and Description
______    _____________________________________________________________________

RecRev     ( 23X, A4 ), where the reversion line before editing appears as:

           REC #RecRev:  ....I....I....I....I....I....I
                         DIGITIZED WITH ADS REV r.rr

                                   -or after editing-
           REC #RecRev:
                 ( 15X, A10, 7X, 2(I2,1X), I4, 6X, 3(1X,I2), 6X, F6.2 )

....I....I....I....I....I....I....I....I....I....I....I....I....I....I
EDITED    BY   AAAAAAAAAA  DATE=mm/dd/yyyy  TIME=hh:mm:ss  REV=rrr.rr

               WHERE: <rrr.rr> is the reversion number

RecRev+K   ( 16X, A10, 7X, 2(I2,1X), I4, 6X, 3(1X,I2), 6X, F6.2 )

....I....I....I....I....I....I....I....I....I....I....I....I....I....I
REGISTERED BY   AAAAAAAAAA  DATE=mm/dd/yyyy  TIME=hh:mm:ss  REV=rrr.rr

               WHERE: K = 0 to <number of times file has been re-registered)
```

ADS Revision 8.00
Data File Specifications
Page 4.

Format for non-latitude/longitude maps (map types 3, 4, and 5)

```
Record
Number    Record Format and Description
-------   ---------------------------------------------------------------------

  1       ( 6I5 ), where 6I5 is a line pointer to:

                  scale data records              <RecScl>
                  map type record                 <RecTyp>
                  longitude record                <RecLon>
                  latitude record                 <RecLat>
                  registration point records      <RecReg>
                  revision records                <RecRev>

          Example:
               REC #1:  ....I....I....I....I....I....I
                            2    5    6    6    6   13

RecScl    ( 20X, F10.0 ), where the line appears as:

      REC #RecScl: ....I....I....I....I....I....I
                   ACTUAL MAP SCALE  1:nnnnnnnnn.

RecScl+2  ( 21X, F12.1 ), where the line appears as:

      REC #RecScl+1:
            ....I....I....I....I....I....I....I
            CALCULATED MAP ACRES=nnnnnnnnnn.n

RecTyp     ( 9X, I1, 1X, A20 ), where the map type line appears as:

          REC #RecTyp:  ....I....I....I....I....I....I....I
                        MAP TYPE=n=AAAAAAAAAAAAAAAAAAAA

RecReg     ( 89X ), where this is a text line only (column titles).

                Then: Read RecReg+K, while K = 1 to 4

RecReg+K  ( I4, 3X, 2F8.3 ), where each line appears as:

          REC #RecReg+K:   ....I....I....I....I....I
                              1   xxxx.xxxyyyy.yyy

RecReg+5   (?????)  This is a guess based on flimsy data:

          REC #RecReg+5:
....I....I....I....I....I....I....I....I....I....I....I....I....I....I
i/8 TOWNSHIP iiii (N/S)  i/8 iiii (E/W) OF THE ______________________
....I....I
MERIDIAN
```

ADS Revision 8.00
Data File Specifications
Page 5.

```
Record
Number    Record Format and Description
______    ____________________________________________________________

RecReg+6  ( 29X, A14 ), where the line appears as:

          REC #RecReg+6:
                    ....I....I....I....I....I....I....I....I....I
                                        STATE OF AAAAAAAAAAAAAA

RecRev     ( 23X, A4 ), where the reversion line appears as:

           REC #RecRev:  ....I....I....I....I....I....I
                         DIGITIZED WITH ADS REV r.rr

RecRev+1  ( 15X, A10, 7X, 2(I2,1X), I4, 6X, 3(1X,I2) ):

          REC #RecRev+1:
        ....I....I....I....I....I....I....I....I....I....I....I....I
        DIGITIZED BY   AAAAAAAAAA  DATE=mm/dd/yyyy  TIME=hh:mm:ss
```

ADS Revision 8.00
Data File Specifications
Page 6.

FILENAME: <mapname>.<menuname>.<L or C or D>; where <menuname> is the first six characters of the theme, thus: LANDLINES = LANDLI.

Contents: Line data format. The .L file contains line data for the line file. The POLYGON command turns the .L file to a .C file which contains line data for polygons. In the .C file, lines only intersect at endpoints. The .D file contains any line segments that were discarded during polygonizing. Line segments in the .D file are usually unneeded, but if a line is signigicant it may have been discarded because it did not intersect another line (within tolerances).

Data format: Direct access, 90 characters per record.

```
Record
Number    Record Format and Description
------    ---------------------------------------------------------

  1       ( I5, I6, I4 ),
                The first integer is the number of records (each record will
                     be at least two lines, but may be more).
                The second integer is a pointer to the pointer line(s).
                     Each integer on the pointer line(s) is the initial line
                     number for the next consecutive record grouping.
                The third integer is a reformat flag.  If the flag is "1",
                     the file has been reformatted.

          REC #1:  ....I....I....I
                       5   14   1
```

After the first record, each record grouping is as follows (where IGR is Initial Group Record Number):

```
Record
Number    Record Format and Description
------    ---------------------------------------------------------

IGR       ( I6, I4, 3I5, F5.2, A2, F10.2, 6F7.3 ),
          which is the HEADER record for this group:

          ....I....I....I....I....I....I....I....I....I....I....I....I....I
          rrrrrrPPPPnnnnnPPPPPpppppWW.WWllPPPPPPP.PPXXX.XXXYYY.YYYxxx.xxxyy
          ....I....I....I....I....I
          y.yyyXXX.XXXYYY.YYY

          thus:

            Record number        RecNm    (I6)     ) <0 = deleted record
            Line pointer to menu Index    (I4)     ) line type; 0=invisible
            Number of points     NPts     (I5)     } X,Y coordinate pairs
            Polygon #1           Poly1    (I5)     } polygons to which this
            Polygon #2           Poly2    (I5)       line belongs
            Width                Width    (F5.2)   } 0 = no width
            Label flag           LblFlg   (A2)     } blank = no label line;
                                                     LA = label below;
                                                     LC = centered label below
            Perimeter            Perim    (F10.2)  } length in miles
            X Offset             XOff     (F7.3)   ) offset DELTA
            Y Offset             YOff     (F7.3)
            X minimum record     XMin     (F7.3)   ) map inches from point of
            Y minimum record     YMin     (F7.3)     origin this feature/item
            X maximum record     XMax     (F7.3)
            Y maximum record     YMax     (F7.3)
```

IGR+n (6X, 10F7.3), where n = 1 through (NPts+4)/5, and each coordinate line appears as:

```
....I....I....I....I....I....I....I....I....I....I....I....I
      xxx.xxxyyy.yyyxxx.xxxyyy.yyyxxx.xxxyyy.yyyxxx.xxxyyy.y
....I....I....I....I
yyxxx.xxxyyy.yyy
```

where each X,Y coordinate pair is in scaled map inches.

IGR+n+1 (6X, 4F6.2, I3, I1, A52), an optional label line. Note: this line does not appear if the label flag in the record header line is blank. Note: Only 30 characters are used in MOSS.

```
....I....I....I....I....I....I....I....I....I....I....I....I....I
      XXX.XXYYY.YYhhh.hhaaa.aaNNNfaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa...
```

thus:

X label direction	XLabel	(F6.2)	} map inches from point of
Y label direction	YLabel	(F6.2)	origin this feature/item
Height of label	Size	(F6.2)	}
Angle of label	Angle	(F6.2)	}
Number of characters	SzLbl	(I3)	}
Font information	IFontF	(I1)	} blank or 0 = no additional font information; 1 = additional information <map>.<menu>.<l c d>.f
Label	Label	(A52)	} Only 30 characters are used in MOSS.

ADS Revision 8.00
Data File Specifications
Page 7.

FILENAME: <mapname>.BORDER

Contents: allows up to 500 data points in the map border.
Data format: Direct access, 90 characters per record.

```
Record
Number   Record Format and Description
------   ---------------------------------------------------------------

  1      ( I5 ), thus:  REC #1  ....I
                                 300

  1+N    ( 10F8.3 ), where N = 1 through
                                       (number of data pairs + 9)/5.

         thus:  REC#1+N: pair 1             ...   pair 5
                         ....I....I....I.   ...   I....I....I....I
                         xxxx.xxxyyyy.yyy   ...   xxxx.xxxyyyy.yyy
```

FILENAME: <mapname>.MENUS

Contents: menu data (allowable themes for this <mapname>).
Data format: Direct access, 20 characters per record.

```
Record
Number   Record Format and Description
------   ---------------------------------------------------------------

   1     ( I5 ), number of menus in this file.

         REC# 1:   ....I....I
                         3

 1+N     ( 10A2 ), menu name; where N = 1 through the number of menus.

         REC# 1+N:  ....I....I....I....I....I.
                    LANDLINES
                    TRANSPORTATION
```

ADS Revision 8.00
Data File Specifications
Page 8.

FILENAME: <mapname>.<menuname>.S; where <menuname> is the first six characters of the theme, thus: LANDLINES = LANDLI.

Contents: Point/symbol data
Data format: Direct access, 90 characters per record.

Record Number	Record Format and Description
1	(I5, I6, I4), number of symbol lines; next available record; reformat flag.

```
Example REC #1:  ....I....I....I
                    10   12   1
```

Record Number	Record Format and Description
1+N	(I6, I2, 2F6.3, F4.2, F5.2, F6.2, I2, I1, A52), where N = 1 through the number of symbol lines. Note: Only 30 characters are used in MOSS.

REC #1+N:

```
....I....I....I....I....I....I....I....I....I....I....I....I....I....I
rrrrrrPPxx.xxxyy.yyyw.wwhh.hhaaa.aawwfaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa...
```

thus:

Record number	RecNum	(I6)	}	
Pointer into menu file	ItemMn	(I2)	}	symbol type
X label direction	XLabel	(F6.3)	}	map inches from point of
Y label direction	YLabel	(F6.3)		origin this feature/item
Width of label	Width	(F4.2)	}	
Height of label	Size	(F5.2)	}	
Angle of label	Angle	(F6.2)	}	in degrees
Number of characters	SzLbl	(I2)	}	
Font information	IFontF	(I1)	}	blank or 0 = no additional font information; 1 = additional information <map>.<menu>.s.f
Label	Label	(A52)	}	Only 30 characters are used in MOSS.

ADS Revision 8.00
Data File Specifications
Page 9.

FILENAME: <mapname>.<menuname>.A; where <menuname> is the first six characters of the theme, thus: LANDLINES = LANDLI.

Contents: attribute data file (1 record per attribute).
Data format: Direct access, 90 characters per record.

Record Number	Record Format and Description
1	(I5, I6, I4), number of attribute lines; next available record; reformat flag.
1+N	(I6, I5, 2F6.3, 2F6.2, I2, I1, A52), where N = 1 through the number of attribute lines. Note, only 30 characters are used in MOSS.

```
Example REC #1:  ....I....I....I
                    10   12    1
```

REC #1+N:

```
....I....I....I....I....I....I....I....I....I....I....I....I....I
rrrrrrPPPPPxx.xxxyy.yyyhhh.hhaaa.aaNNfaaaaaaaaaaaaaaaaaaaaaaaaaaaaa...
```

thus:

Record number	RecNum	(I6)	}
Polygon number	IPoly	(I5)	} pointer to .P record number
X label direction	XLabel	(F6.3)	} map inches from point of
Y label direction	YLabel	(F6.3)	origin this feature/item
Height of label	Size	(F6.2)	}
Angle of label	Angle	(F6.2)	} in degrees
Number of characters	NChars	(I2)	}
Font information	Font	(I1)	} blank or 0 = no additional font information; 1 = additional information <map>.<menu>.A.F
Label	ALabel	(A52)	} Note: Only 30 characters are used in MOSS.

ADS Revision 8.00
Data File Specifications
Page 10.

FILENAME: <mapname>.<menuname>.P; where <menuname> is the first six characters of the theme, thus: LANDLINES = LANDLI.

Contents: polygon data: pointers to .A, .C, and .E files.
Data format: Direct access, 90 characters per record.

Record Number	Record Format and Description
1	(I5, I6, I4), number of polygon records; next available record; reformat flag.

Example REC #1:

```
....I....I....I
   10   12    1
```

Then..... 1 through N where N = number of polygon records and where each record consists of one header record (PH), two attribute records, and 1 thru NLines (where NLines = (NPts + 14) / 15, 15 being the maximum number of pointers per line.

PH (I6, I4, I5, 2I4, I5, F10.2, F10.1, 4F7.2), where PH = the next available line after record number 1 or after the last line of the previous polygon set.

REC #PH (polygon header record):

```
....I....I....I....I....I....I....I....I....I....I....I....I
rrrrrrsssseeeeeaaaannnnfffffPPPPPPP.PPAAAAAAAA.Axxxx.xxyyyy.
....I....I....I....I
yyXXXX.XXYYYY.YY
```

thus:

Record number	RecNum	(I6)	)
Pointer to menu file	ShdPtr	(I4)	} shade type
Pointer to .E file	NmEncl	(I5)	) line number in .E file; 0 = no enclosed polygons
Number of attributes	NmAttr	(I4)	) number of pointers to find
Number of lines	NPts	(I4)	) number of pointers to find; lines to read=(NPts+15)/16
Enclosing polygon	Father	(I5)	) record number of parent polygon; 0 = not enclosed
Perimeter	Primtr	(F10.2)	) in miles
Area	Area	(F10.1)	) in acres
X minimum record	XMin	(F7.3)	} map inches from point of origin this feature/item
Y minimum record	YMin	(F7.3)	
X maximum record	XMax	(F7.3)	
Y maximum record	YMax	(F7.3)	

ADS Revision 8.00
Data File Specifications
Page 11.

Record Number	Record Format and Description
PH+1	(16I5), where 20 is the maximum possible number of attributes. If NmAttr = 0, then there are no attributes, otherwise there are NmAttr attributes. Each number on the AT line points to a record number in the .A file (pointer = attribute record number + 1).

```
REC #PH+1 (AT): ....I....I....I....I....I  ...  ....I....I....I
                nnnnnNNNNNnnnnnNNNNNnnnnn  ...  nnnnnNNNNN
```

Record Number	Record Format and Description
PH+2	(4I5), the remaining four attribute pointers.

```
REC #PH+2     : ....I....I....I....I....I....I....I....I
                nnnnnNNNNNnnnnnNNNNN
```

Record Number	Record Format and Description
AT+1+N	(15I6), where 15 is the maximum number of pointers on a line. N = 1 through (NPts+14)/15. Each number on the LI line points to a record in the .C file (pointer = record number and IS NOT the line number in the .C file).

```
REC #AT+1+N (LI): ....I....I....I....I....I ...
                  nnnnnnNNNNNNnnnnnnNNNNNN...
```

ADS Revision 8.00
Data File Specifications
Page 12.

```
FILENAME:  <mapname>.<menuname>.E; where <menuname> is the first six
           characters of the theme, thus: LANDLINES = LANDLI.

           Contents:     enclosed polygon pointers back to .P file
           Data format:  Direct access, 90 characters per record.

Record
Number    Record Format and Description
______    ____________________________________________________________

  1       ( I5, I6, I4 ),  last record number used; a dummy value;
                           reformat flag.  Thus:   ....I....I....I
                                                       3    0   1

            Then..... 1 through N where N = number of enclosed records and
                      where each record consists of one header record (EH),
                      1 thru NLines (where NLines = ( NPts + 15 ) / 16, 16
                      being the maximum number of pointers per line.

  EH      ( 2(10X,I5) ); where EH = the next available line after record
          number 1 or after the last line of the previous enclosed polygon
          set.

          REC #EH:  ....I....I....I....I....I....I....I....I
                    POLYGON # ppppp   HAS    nnnnn ENCLOSED  ...

                    where:  ppppp = parent polygon
                            nnnnn = number of enclosed polygons below (NPts)

  EH+N    ( 16I5 ); where N = ( NPts + 15 ) / 16, (NLines).

          REC #EH+N: ....I....I....I....I....I  ... ....I....I....I
                     nnnnnNNNNNnnnnnNNNNNnnnnn  ... nnnnnNNNNN

                     where: nnnnn = is a pointer back to the .P file;
                                    this pointer is the number of the island
                                    polygon (it is not the position of the
                                    of the record in the .P file).
```

ADS Revision 8.00
Data File Specifications
Page 13.

The remaining file formats are from the PRELIMINARY format document of 6/23/86.

```
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
mapname.TEXT   --  TEXT DATA 1 RECORD PER TEXT ITEM
                   DIRECT ACCESS, 90 CHARACTER RECORDS
        REC#1 = # TEXT ITEMS, NEXT AVAILABLE RECORD, REFORMAT FLAG (I5,I6,I4)
        REC#2

        REC#n = IREC,XLAB,YLAB,SIZE,ANGLE,NWRDS,IFONTF,LABEL
               (I6  ,F6.2,F6.2,F6.2,F6.2 ,I2   ,I1    ,A52  )

        IREC        <= 0 = THIS TEXT ITEM HAS BEEN DELETED
        (XLAB,YLAB)  = POSITION OF TEXT ITEM
        SIZE         = HEIGHT
        ANGLE        = ANGLE IN DEGREES
        NWRDS        = # NWORDS IN LABEL (MAX=52)
        IFONTF       = ' ' (BLANK)  = NO ADDITIONAL FONT INFORMATION
                     = 0            = NO ADDITIONAL FONT INFORMATION
                     = 1            = ADDITIONAL FONT INFORMATION FOUND ON
                                      mapname.TEXT.F
        LABEL        = LABEL ARRAY

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
mapname.PRINT   -- contains same information that was displayed on the screen
                   command POLYGON was executed.  Actual format of file is
                   unimportant.  You can easily dispose this file to printer
                   by using POLYGON.PRINT.CLI

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
mapname.EDG     -- results of EDGEFIT command.  Contains information about
                   which RAW LINES intersect the map boundary.

        REC#1 = NODES(1),NODES(2),NODES(3),NODES(4)
                (  I3    ,   I3    ,   I3    ,   I3   )
                       NODES(IDIR)=# of intersections along boundary IDIR
                                       where  IDIR=1=west
                                                  =2=north
                                                  =3=east
                                                  =4=south
                               intersections info to follow
                               TOTAL # INTERSECTIONS = NODES(1) + NODES(2) +
                                                       NODES(3) + NODES(4)

        REC#n = JDIR,IDX,ITEM,XINT,YINT
                ( I1, I5, I6, F8.2, F8.2)
                       JDIR = boundary of intersection (1,2,3,4)
                       IDX  = index # of segment that intersects boundary
                               (X(IDX-1),Y(IDX-1)) - (X(IDX),Y(IDX))
                       ITEM = RAW LINE item # that intersects boundary
                       (XINT,YINT)= (X,Y) location of intersection
                                       in local map inches
```

```
ADS Revision 8.00
Data File Specifications
Page 14.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
mapname.menuname.datatype.F
       OR
mapname.TEXT.F

FONT INFORMATION FOR LABELS, ATTRIBUTES, TEXT

  IFONTF IS A FLAG IN THE "PARENT FILE" INDICATING THAT ADDITIONAL
  FONT INFORMATION MAY BE FOUND IN THIS FILE.

DATA FORMAT:      DIRECT ACCESS, 90 CHARACTERS PER RECORD

         ***********************************************
     REC#1 = # OF FONT ITEMS, NEXT AVAILABLE RECORD, REFORMAT FLAG  (I5,I6,I4)

     REC#n =  IPOINT  , IFONT, IPENLOC, SLANTI )
              (I10    , I3   , I3     ,  F6.2  )

     IPOINT = RECORD NUMBER POINTER, INDICATES ASSOCIATED "PARENTFILE" RECORD
              NUMBER, "PARENT FILE" CONTAINS TEXTUAL INFORMATION AND
              ADDITIONAL FONT/TEXT INFORMATION.

     IFONT  = FONT TYPE
              (INTEGER VALUE, MINIMUM VALUE =0,MAXIMUM VALUE= 999 ) CURRENT
              PERMISSIBLE VALUES ARE: 1-8, 11-16, 23, 24, 26, 32, 33, 51-53

     IPENLOC = PEN NUMBER

     SLANTI = ITALICS SLANT ANGLE IF ANY
              (REAL VALUE IN DEGREES,MINIMUM VALUE = -90.00,
                                     MAXIMUM VALUE = +90.00,
                                     DEFAULT VALUE = -23.00 )
```

EXHIBIT D-10: FILENAMES FOR THE PROJECT PACKAGE

The finenames of the source code for the USGS Projection Package are as follows.

ADJLO.F77
ALO10.F77
AL290.F77
DEGPAK.F77
DMSPO.F77
DRIVEO.F77
EOFNO.F77
E1FNO.F77
E2FNO.F77
E3FNO.F77
ELIPSE.F77
GTDEF.F77
GTPOO.F77
GTRAN.F77
GTRBD.F77
GTRBD1.F77
GTRBD2.F77
GTRBD3.F77
GTRIF.F77
GTRNO.F77
GTSET.F77
IS010.F77
IS020.F77
IS030.F77
IW040.F77
IS050.F77
IS060.F77
IS070.F77
IS080.F77
IS090.F77
IS100.F77
IS110.F77
IS120.F77
IS130.F77
IS140.F77
IS150.F77
IS160.F77
IS170.F77
IS180.F77
IS190.F77
IS1A0.F77
IS200.F77
MLFNO.F77
MSFNO.F77
PAKDO.F77
PAKPAR.F77
PAKRO.F77
PAKSO.F77
PF010.F77
PF020.F77
PF030.F77
PF040.F77
PF050.F77
PF060.F77
PF070.F77
PF080.F77
PF090.F77
PF100.F77
PF110.F77
PF120.F77
PF130.F77
PF140.F77
PF150.F77
PF160.F77
PF170.F77
PF180.F77
PF190.F77
PF1A0.F77
PF200.F77
PHI10.F77
PHI20.F77
PHI30.F77
PHI40.F77
PI010.F77
PI020.F77
PI030.F77
PI040.F77
PI050.F77
PI060.F77
PI070.F77
PI080.F77
PI090.F77
PI100.F77
PI110.F77
PI120.F77
PI130.F77
PI140.F77
PI150.F77
PI160.F77
PI170.F77
PI180.F77
PI190.F77
PI1A0.F77
PI200.F77
PROIN.F77
PROVW.F77
QSFNO.F77
RADDO.F77
SELELP.F77
SPHDO.F77
TRANSFORM.F77
TSFNO.F77
UNTFO.F77
ZONEO.F77

EXHIBIT D-11: RESERVED

EXHIBIT D-12: RESERVED

EXHIBIT D-13: RESERVED

EXHIBIT D-14: RESERVED

EXHIBIT D-15: RESERVED

EXHIBIT D-16: RESERVED

EXHIBIT D-17: RESERVED

EXHIBIT D-18: ADS FILE FORMAT EXAMPLES

1.0 Bounda.a

```
  2     4   1
   1     2 6.13017.040  0.10  0.00251BENNETT_HILLS_RA_SHOSHONE
   2     1 1.790 2.950  0.10  0.00181JARBRIDGE_RA_BOISE
```

2.0 Bounda.c

```
  5    33   1
   1   3   40    1    2 0.00         2.61  0.000  0.000  1.005  7.268  6.920  8.881
      1.005  8.839  1.221  8.878  1.520  8.881  1.616  8.874  1.681  8.856
      1.890  8.772  2.168  8.693  2.205  8.669  2.320  8.498  2.369  8.458
      2.507  8.398  2.648  8.363  2.694  8.338  3.077  8.194  3.229  8.147
      3.329  8.147  3.377  8.130  3.451  8.117  3.557  8.084  3.677  8.073
      4.138  8.186  4.188  8.193  4.250  8.183  4.341  8.153  4.489  8.192
      4.764  8.253  4.877  8.297  4.958  8.320  5.441  8.365  6.005  8.382
      6.167  8.335  6.389  8.293  6.579  8.169  6.726  8.024  6.778  7.949
      6.855  7.752  6.880  7.488  6.904  7.437  6.920  7.341  6.910  7.268
   2   3   73    1    2 0.00         3.71  0.000  0.000  6.890  1.000 12.148  7.268
      6.910  7.268  6.908  7.209  6.890  7.081  6.929  6.909  6.957  6.834
      7.035  6.688  7.073  6.634  7.198  6.503  7.324  6.449  7.425  6.397
      7.588  6.288  7.689  6.196  7.815  6.030  7.862  6.001  7.990  5.901
      8.062  5.835  8.174  5.700  8.336  5.438  8.534  5.206  8.589  5.122
      8.651  4.948  8.700  4.862  8.841  4.703  8.917  4.641  8.991  4.595
      9.150  4.466  9.397  4.231  9.492  4.126  9.689  3.863  9.798  3.660
      9.812  3.594  9.805  3.516  9.789  3.473  9.745  3.402  9.573  3.392
      9.532  3.362  9.487  3.284  9.469  3.188  9.480  3.148  9.519  3.083
      9.737  2.853  9.794  2.775  9.950  2.655 10.344  2.426 10.378  2.400
     10.417  2.391 10.485  2.397 10.615  2.343 10.899  2.193 11.032  2.109
     11.107  2.101 11.403  2.127 11.621  2.180 11.747  2.195 11.859  2.200
     11.931  2.183 11.975  2.153 12.066  1.999 12.143  1.821 12.148  1.747
     12.134  1.702 12.104  1.655 12.031  1.615 11.907  1.562 11.889  1.547
     11.870  1.484 11.876  1.390 11.887  1.359 11.922  1.320 11.993  1.275
     12.023  1.245 12.072  1.122 12.080  1.000
   3   0    2    1    0 0.00         2.97  0.000  0.000  1.000  1.000  1.005  8.839
      1.000  1.000  1.005  8.839
   4   0    5    2    0 0.00        22.77  0.000  0.000  1.005  1.000 17.766 23.779
      1.005  8.839  1.014 23.779 17.722 23.777 17.766  1.000 12.080  1.000
   5   0    2    1    0 0.00         4.20  0.000  0.000  1.000  1.000 12.080  1.000
     12.080  1.000  1.000  1.000
POINTERS
    2    11    27    29    31     0     0     0     0     0     0     0     0     0     0
```

3.0 Bounda.lf

```
   0     2   1
```

4.0 Bounda.s

```
   4      6   1
    1 212.469 2.5510.10 0.00  0.00 00
    2 212.839 1.9540.10 0.00  0.00 00
    3 212.862 1.8750.10 0.00  0.00 00
    4 212.170 3.0100.10 0.00  0.00 00
```

5.0 Bounds.af

```
2     4   1
     1  0  0  0.00
     2  0  0  0.00
```

6.0 Bounds.1

```
3    68   1
-1   3  199    0    0 0.06        6.56  0.000  0.000  1.005  1.000 12.093   8.828
    1.005  8.798  1.165  8.828  1.241  8.828  1.349  8.806  1.456  8.794
    1.555  8.824  1.614  8.817  1.659  8.792  1.654  8.775  1.632  8.770
    1.626  8.754  1.655  8.745  1.703  8.752  1.774  8.726  1.830  8.715
    1.892  8.674  1.991  8.678  2.054  8.665  2.144  8.612  2.192  8.592
    2.225  8.558  2.265  8.497  2.360  8.424  2.409  8.408  2.477  8.369
    2.666  8.313  2.700  8.270  2.752  8.255  2.888  8.182  3.018  8.163
    3.079  8.146  3.101  8.130  3.200  8.113  3.242  8.091  3.318  8.082
    3.357  8.089  3.530  8.030  3.636  8.005  3.683  8.002  3.794  8.024
    3.907  8.059  4.004  8.097  4.107  8.123  4.316  8.124  4.354  8.119
    4.574  8.195  4.673  8.214  4.729  8.219  4.760  8.229  4.814  8.232
    4.931  8.289  5.084  8.261  5.322  8.287  5.472  8.310  5.513  8.303
    5.637  8.332  5.667  8.346  5.711  8.341  5.759  8.349  6.078  8.327
    6.196  8.300  6.256  8.277  6.325  8.268  6.385  8.247  6.568  8.103
    6.616  8.089  6.683  8.014  6.748  7.928  6.830  7.770  6.837  7.675
    6.854  7.623  6.874  7.475  6.891  7.415  6.886  7.356  6.859  7.330
    6.833  7.156  6.845  7.102  6.866  7.056  6.868  7.001  6.886  6.963
    6.896  6.918  6.938  6.857  6.943  6.812  6.969  6.762  7.180  6.482
    7.276  6.450  7.337  6.421  7.366  6.398  7.383  6.366  7.447  6.349
    7.510  6.320  7.584  6.275  7.671  6.185  7.759  6.078  7.803  6.013
    7.859  5.950  7.935  5.896  7.981  5.833  8.115  5.736  8.173  5.665
    8.316  5.422  8.341  5.363  8.422  5.251  8.499  5.162  8.515  5.113
    8.579  4.976  8.617  4.858  8.681  4.808  8.695  4.751  8.703  4.651
    8.725  4.622  8.768  4.630  8.797  4.651  8.828  4.654  8.905  4.616
    9.015  4.548  9.117  4.471  9.329  4.287  9.641  3.896  9.743  3.744
    9.760  3.672  9.762  3.540  9.751  3.495  9.725  3.474  9.644  3.495
    9.505  3.499  9.398  3.441  9.365  3.339  9.338  3.303  9.335  3.254
    9.344  3.179  9.371  3.111  9.430  3.035  9.529  2.930  9.585  2.898
    9.646  2.895  9.688  2.881  9.716  2.852  9.759  2.744  9.811  2.695
    9.964  2.603 10.043  2.566 10.087  2.530 10.115  2.483 10.155  2.494
   10.206  2.484 10.240  2.461 10.261  2.416 10.302  2.414 10.338  2.400
   10.350  2.367 10.368  2.350 10.415  2.344 10.458  2.327 10.487  2.302
   10.530  2.299 10.589  2.251 10.628  2.245 10.659  2.226 10.685  2.197
   10.723  2.179 10.801  2.178 11.051  2.074 11.112  2.065 11.176  2.072
   11.212  2.087 11.306  2.082 11.549  2.112 11.675  2.116 11.793  2.149
   11.854  2.149 11.919  2.135 11.980  2.100 12.085  1.872 12.093  1.810
   12.083  1.762 12.007  1.697 11.961  1.690 11.894  1.708 11.877  1.687
   11.806  1.660 11.792  1.636 11.792  1.539 11.785  1.500 11.795  1.440
   11.791  1.422 11.800  1.389 11.797  1.355 11.815  1.346 11.843  1.360
   11.863  1.311 11.894  1.298 11.933  1.274 11.957  1.278 11.979  1.245
   12.001  1.192 12.011  1.111 12.032  1.075 12.047  1.000
 2   3   40    0    0 0.00        2.61  0.000  0.000  0.995  7.269  6.920   8.881
    0.995  8.837  1.221  8.878  1.520  8.881  1.616  8.874  1.681  8.856
    1.890  8.772  2.168  8.693  2.205  8.669  2.320  8.498  2.369  8.458
    2.507  8.398  2.648  8.363  2.694  8.338  3.077  8.194  3.229  8.147
    3.329  8.147  3.377  8.130  3.451  8.117  3.557  8.084  3.677  8.073
    4.138  8.186  4.188  8.193  4.250  8.183  4.341  8.153  4.489  8.192
    4.764  8.253  4.877  8.297  4.958  8.320  5.441  8.365  6.005  8.382
    6.167  8.335  6.389  8.293  6.579  8.169  6.726  8.024  6.778  7.949
    6.855  7.752  6.880  7.488  6.904  7.437  6.920  7.341  6.910  7.269
    3   3   73    0     0 0.00        3.71  0.000  0.000  6.890  1.000 12.148  7.268
       6.909  7.268  6.908  7.209  6.890  7.081  6.929  6.909  6.957  6.834
       7.035  6.688  7.073  6.634  7.198  6.503  7.324  6.449  7.425  6.397
       7.588  6.288  7.689  6.196  7.815  6.030  7.862  6.001  7.990  5.901
       8.062  5.835  8.174  5.700  8.336  5.438  8.534  5.206  8.589  5.122
       8.651  4.948  8.700  4.862  8.841  4.703  8.917  4.641  8.991  4.595
       9.150  4.466  9.397  4.231  9.492  4.126  9.689  3.863  9.798  3.660
       9.812  3.594  9.805  3.516  9.789  3.473  9.745  3.402  9.573  3.392
       9.532  3.362  9.487  3.284  9.469  3.188  9.480  3.148  9.519  3.083
       9.737  2.853  9.794  2.775  9.950  2.655 10.344  2.426 10.378  2.400
      10.417  2.391 10.485  2.397 10.615  2.343 10.899  2.193 11.032  2.109
      11.107  2.101 11.403  2.127 11.621  2.180 11.747  2.195 11.859  2.200
      11.931  2.183 11.975  2.153 12.066  1.999 12.143  1.821 12.148  1.747
      12.134  1.702 12.104  1.655 12.031  1.615 11.907  1.562 11.889  1.547
      11.870  1.484 11.876  1.390 11.887  1.359 11.922  1.320 11.993  1.275
      12.023  1.245 12.072  1.122 12.080  1.000
POINTERS
    -2     43     52      0      0      0      0      0      0      0      0      0      0      0      0
```

7.0 Bounda.p

```
    2     10    1
     1    0     0    1    4     0      13.49      5405.5  1.000   1.000 12.148   8.881
    2     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    0     0     0     0
     1      2      5      3
     2    0     0    1    3     0      29.09    29601.8  1.005   1.000 17.766 23.779
    1     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    0     0     0     0
     4     -2     -1
POINTERS
     2      6      0      0      0      0      0      0      0      0      0      0      0      0      0
```

8.0 Menus

```
    9
LANDLINES
BOUNDARIES
SOILS
TRANSPORTATION
GSTREAMS
GLAKES
GA.ALLOTMENTS
COUNTIES
OWNERSHIP
```

EXHIBIT D-19: PCCS DATA FILENAMES

There are PCCS data files from 46 townships, each township contains three PCCS data files. The three PCCS files are in the A, L and X file formats respectively. These file formats are defined in Exhibit D-6. The complete list of file names is as follows.

Township	Filenames
T21N6W	A21N6W L21N6W X21N6W
T21N7W	A21N7W L21N7W X21N7W
T21N8W	A21N8W L21N8W X21N8W
T22N6W	A22N6W L22N6W X22N6W
T21N9W	A21N9W L21N9W X21N9W
T22N7W	A22N7W L22N7W X22N7W
T22N8W	A22N8W L22N8W X22N8W
T22N9W	A22N9W L22N9W X22N9W

T23N9W	A23N9W
	L23N9W
	X23N9W
T23N8W	A23N8W
	L23N8W
	X23N8W
T23N7W	A23N7W
	L23N7W
	X23N7W
T23N6W	A23N6W
	L23N6W
	X23N6W
T24N6W	A24N6W
	L24N6W
	X24N6W
T24N7W	A24N7W
	L24N7W
	X24N7W
T24N8W	A24N8W
	L24N8W
	X24N8W
T24N9W	A24N9W
	L24N9W
	X24N9W
T25N6W	A25N6W
	L25N6W
	X25N6W
T25N7W	A25N7W
	L25N7W
	X25N7W
T26N6W	A26N6W
	L26N6W
	X26N6W

T28N5W	A28N5W
	L28N5W
	X28N5W
T28N6W	A28N6W
	L28N6W
	X28N6W
T28N7W	A28N7W
	L28N7W
	X28N7W
T29N5W	A29N5W
	L29N5W
	X29N5W
T29N6W	A29N6W
	L29N6W
	X29N6W
T29N7W	A29N7W
	L29N7W
	X29N7W
T29N8W	A29N8W
	L29N8W
	X29N8W
T29N9W	A29N9W
	L29N9W
	X29N9W
T29N10W	A29N10W
	L29N10W
	X29N10W
T29N11W	A29N11W
	L29N11W
	X29N11W
T29N12W	A29N12W
	L29N12W
	X29N12W

T30N11W	A30N11W L30N11W X30N11W
T30N10W	A30N10W L30N10W X30N10W
T30N9W	A30N9W L30N9W X30N9W
T30N8W	A30N8W L30N8W X30N8W
T30N7W	A30N7W L30N7W X30N7W
T30N6W	A30N6W L30N6W X30N6W
T30N5W	A30N5W L30N5W X30N5W
T31N5W	A31N5W L31N5W X31N5W
T31N6W	A31N6W L31N6W X31N6W
T31N7W	A31N7W L31N7W X31N7W
T32N5W	A32N5W L32N5W X32M5W

T32N6W	A32N6W L32N6W X32N6W
T26N7W	A26N7W L26N7W X26N7W
T27N7W	A27N7W L27N7W X27N7W
T27N6W	A27N6W L27N6W X27N6W
T27N5W	A27N5W L27N5W X27N5W

National Mapping Program
Technical Instructions
Data Users Guide 1

US GeoData

Digital Line Graphs from 1:24,000-Scale Maps

Data Users Guide

Department of the Interior
U. S. Geological Survey

DATA USERS GUIDES

1: Digital Line Graphs from 1:24,000-Scale Maps
2: Digital Line Graphs from 1:100,000-Scale Maps
3: Digital Line Graphs from 1:2,000,000-Scale Maps
4: Land Use and Land Cover Digital Data from 1:250,000- and 1:100,000-Scale Maps
5: Digital Elevation Models
6: Geographic Names Information System
7: Alaska Interim Land Cover Mapping Program

Data Users Guides 1-7 generally replace the Geological Survey Circular 895.

Questions regarding availability and ordering of US GeoData (all types of digital cartographic and geographic data produced and distributed by the U.S. Geological Survey) should be addressed to:

Earth Science Information Center
U.S. Geological Survey
507 National Center
Reston, Virginia 22092
(703)860-6045

Technical questions and comments should be addressed to:

Branch of Technical Management
U.S. Geological Survey
510 National Center
Reston, Virginia 22092

UNITED STATES
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

DIGITAL LINE GRAPHS FROM 1:24,000-SCALE MAPS

Data Users Guide 1

Reston, Virginia
1990

First printing, 1986
Second printing (revised), 1990

CONTENTS

Page

Introduction 1
Data content 2
Data structure 3
    Levels of structuring 3
    Topology 4
    Topological elements 4
Attribute codes 4
    Major attribute codes 6
    Minor attribute codes 6
    Sample attribute codes 7
Sample line graph structure 8
Graph theory in DLG data 10
    Area case 10
    Network case 11
    Area-Hybrid case 11
Distribution formats 17
Source materials 18
Cell size and file extent 18
Coordinate systems 18
    Standard distribution format 18
    Optional distribution format 19
Data validation 19
Appendix A. Standard DLG distribution format (record contents) 25
    B. Optional DLG distribution format (record contents) 36
    C. Map projection parameters 49
    D. DLG attribute codes 50
    E. Coordinate conversion 71
    F. Sample DLG data file (standard distribution format) 72
    G. Sample DLG data file (optional distribution format) 76
    H. Pre-1983 Hydrographic attribute codes 79
    I. Pre-1985 Transportation attribute codes 85
    J. Pre-1985 Other Significant Cultural Feature attribute codes 92
    K. Origins of the U.S. Rectangular Surveys 97
    L. Named Land Grant codes 98

ILLUSTRATIONS

Page

Figure 1. Map elements showing roads, railroads, buildings, streams, and lake and forest areas 5
2. Sample line graph 8
3. Window from the Oneco, Connecticut-Rhode Island, USGS 1:24,000-scale quadrangle map 12
4. Window from the line graph of hydrography, Oneco, Connecticut-Rhode Island, quadrangle 13
5. Location of origin of file reference coordinates 19

TABLES

Page

Table 1. Major codes used for DLG base categories 6
2. Digital description of sample DLG-3 9
3. Selected sample of standard format DLG-3 records for Oneco, Connecticut-Rhode Island, hydrography 14
4. Standard and optional DLG format 17

DIGITAL LINE GRAPHS FROM 1:24,000-SCALE MAPS

INTRODUCTION

The Earth Science Information Centers (ESIC) distribute digital cartographic/geographic data files produced by the U.S. Geological Survey (USGS) as part of the National Mapping Program. Digital cartographic data files are grouped into four basic types. The first of these, called a Digital Line Graph (DLG), is line map information in digital form. These data files include information on planimetric base categories, such as transportation, hydrography, and boundaries. The second type, called a Digital Elevation Model (DEM), consists of a sampled array of elevations for a number of ground positions that are usually at regularly spaced intervals. The third type is Land Use and Land Cover digital data, which provides information on nine major classes of land use such as urban, agricultural, or forest as well as associated map data such as political units and Federal land ownership. The fourth type, the Geographic Names Information System, provides primary information for all known places, features, and areas in the United States identified by a proper name.

The digital cartographic data files from selected quadrangles currently available from ESIC include the following:

- Digital Line Graphs (DLG)
  --1.24,000-scale
  --1:62,500-scale
  --1:63,360-scale
  --1:100,000-scale
  --1:2,000,000-scale

- Digital Elevation Models (DEM)
  --7.5-minute
  --15-minute
  --30-minute
  --1-degree

- Land Use and Land Cover digital data
  --1:250,000- and 1:100,000-scale Land Use and Land Cover and associated maps
  --1:250,000-scale Alaska Interim Land Cover

- Geographic Names

The digital data are useful for the production of cartographic products such as plotting base maps and for various kinds of spatial analysis. A major use of these digital cartographic/geographic data is to combine them with other geographically referenced data enabling scientists to conduct automated analysis in support of various decision making processes.

Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government. Manuscript approved for publication September 4, 1986.

This document describes the Digital Line Graphs (DLG's) prepared primarily from the 1:24,000 materials associated with the USGS Topographic Map Series. The series will eventually provide complete national coverage.

DATA CONTENT

The DLG data files derived from the 1:24,000-scale and other large-scale maps contain selected base categories of cartographic data in digital form; these data categories do not necessarily correspond to the traditional feature separates associated with the maps. The attribute coding scheme for these data has undergone several revisions since the start of the digital program. A major revision of these codes has been printed as Standards for Digital Line Graphs - Part 3, Attribute Coding, which is available for purchase from a USGS ESIC office (see the ordering information inside the front cover). Currently, DLG data entered in the National Digital Cartographic Data Base (NDCDB) are coded in accordance with the Standards for Digital Line Graphs. The implementation of the new coding standards will require the updating of existing files in the NDCDB in order to have a consistent product available for users. Software and procedures are being developed to convert existing data files to these codes during the next several years. Priority will be given to converting files retrieved in response to sales requests. In the meantime, a data base query will provide identification of the coding scheme used for any file in the NDCDB. This information will be supplied to customers when orders are submitted, and upon transmittal of data files. The following categories are included in current large-scale DLG files:

- Boundaries -- This category of data consists of (1) political boundaries that identify States, counties, cities, and other municipalities, and (2) administrative boundaries that identify areas such as National and State forests. Political and administrative boundaries are always collected as a single data set.

- Hydrography -- This category of data is currently being collected as combined hydrography consisting of all flowing water, standing water, and wetlands.

  Prior to 1983, hydrographic data were differentiated into two components: streams and water bodies. Streams represent flowing water and were digitized as a network intended for hydrologic flow modeling. Streams included the banks of double-line rivers and centerline connectors placed through double-line rivers and lakes. Water bodies include standing water such as lakes and ponds. Wetlands and coastal hydrographic data were not collected. Appendix H contains a list of the attribute codes used in these files.

- Public Land Survey System (PLSS) -- This category of data describes the rectangular system of land surveys that is administered by the U.S. Bureau of Land Management. PLSS data are only collected for areas falling solely, or in part, within the States that were formed from the public domain. The PLSS subdivides the public domain and represents property boundaries or references to property boundaries. These DLG data are not intended to be official or authoritative. They are presented as cartographic reference information. The only legal basis for determining land boundaries remains the original survey.

- Transportation -- This category of data includes major transportation systems collected in three separate overlays labeled: (1) Roads and Trails, (2) Railroads, and (3) Pipelines, Transmission Lines, and Miscellaneous Transportation Features.

  In the last quarter of 1985, new transportation attribute codes were implemented. The principal difference between the old and new coding schemes is that under the old transportation subcategory, certain miscellaneous transportation features were not collected and descriptive attribute codes were not used. Appendix I contains a list of the attribute codes formerly used.

- Other Significant Manmade Structures -- This category of data includes miscellaneous cultural features not included in the other major data categories.

  New attribute codes for Other Significant Manmade Structures were implemented in the last quarter of 1985. Very little data from this category currently reside in the NDCDB. Appendix J contains a list of the attribute codes used for these older files.

The attribute codes for the following base categories were newly defined in late 1985. Currently, there are very little data available in these categories.

- Hypsography -- This category of data consists of information on topographic relief (primarily contour data).

- Surface Cover -- This category of data consists of information about vegetative surface cover such as woods, scrub, orchards, and vineyards. Vegetative features associated with wetlands, such as marshes and swamps, are collected under Hydrography.

- Non-Vegetative Surface Features -- This category of data consists of information about the natural surface of the Earth as symbolized on the map such as lava, sand, and gravel features. This category is not all-inclusive, as other non-vegetative surface features are found in the category of Hydrography.

- Survey Control and Markers -- This category of data consists of information about the points of established position and third-order or better elevations that are used as fixed references in positioning and correlating map features.

DATA STRUCTURE

Levels of Structuring

The term Digital Line Graph (DLG) is used by the USGS to describe a digital map data set in vector form. Originally, three levels of DLG data (DLG-1, DLG-2, and DLG-3) were envisioned; these levels were differentiated by their positional accuracy, level of attribute coding, and relational spatial information. It was found, however, that the widest user-community would be served by producing DLG-3 data, which have the full range of attribute codes and are fully topologically structured. These two properties are required by users whose work includes both graphic and analytic applications. Therefore, all DLG data in the National Digital Cartographic Data Base are level 3.

Topology

Current data collection from 1:24,000-scale and other large-scale maps is exclusively directed toward producing fully topologically structured level 3 DLG data referred to as DLG-3. The DLG-3 concept is based on graph theory in which a two-dimensional diagram is expressed as a set of nodes (topologically significant points), lines, and areas in a manner that explicitly expresses logical relationships. Applied to a map, this concept is used to encode the digital data with the spatial relationships between map elements which are obvious when the map is examined visually. The spatial relationships include such concepts as adjacency and connectivity between features on the map. The abstraction of the map data according to the rules of graph theory preserves the spatial relationships inherent in the map graphic and creates a logical and consistent data file structure for computer processing. A digital file of cartographic or geographic data that maintains the spatial relationships inherent in the map is called a topologically structured data file. A topologically structured data file can support simple graphic applications, such as plotting streams and roads for base maps, as well as more advanced applications, such as computations and analyses involving areas and lines and their spatial relationships.

Topological Elements

A DLG-3 file is composed of three separate, but related, elements: nodes, lines, and area identifiers. Nodes define the location of the endpoints of every line, and a single node may mark the start or end of one or more lines. Thus, nodes occur at intersections of linear features and other places on linear features where the feature is subdivided into separate line segments.

A line is an ordered set of points that describes the position and shape of a linear feature on the map. Each line starts at a node and ends at a node, and has an area to the left of its direction of travel, and has an area to the right of its direction of travel. The direction of travel is arbitrarily determined at the time of data capture. Lines connect to each other at nodes, and a line does not cross itself or any other line. A line may describe the boundary between two areal map features, such as counties, or may define a map feature by itself, such as a road. A special line, called a degenerate line, is used to define features symbolized as independent points on a map. A degenerate line starts and ends at the same node, has two identical coordinate pairs, has zero length, and has the same area to the left and right of the direction of travel; that is, it is totally enclosed inside one map area.

An area is a portion of the map bounded by lines. All portions of the map must be assigned some area point. Each area is identified in a DLG-3 data file by a point chosen to represent the characteristics of the area. Newer versions of the processing software, the DLG Production System or PROSYS, locate a given area point inside the area it represents, although this is not a structural requirement. Every DLG data file will have at least two areas identified: one representing the area covered by the file and the other representing the area outside the coverage of the file. Additional areas will be identified as necessary to subdivide the area covered by the file. Polygons as unique features are not defined explicitly in a DLG file. However, polygons can be constructed using line-area linkages built into the DLG data structure.

ATTRIBUTE CODES

In addition to locational and topological information, DLG data elements may have explicitly encoded attributes. Attribute codes, also called feature codes or classification attributes, are used to describe the map information represented by a node, area, or line. For example, the attribute code for an area might identify a lake or swamp; the attribute code for a line might identify a road, railroad, stream, or shoreline (fig. 1).

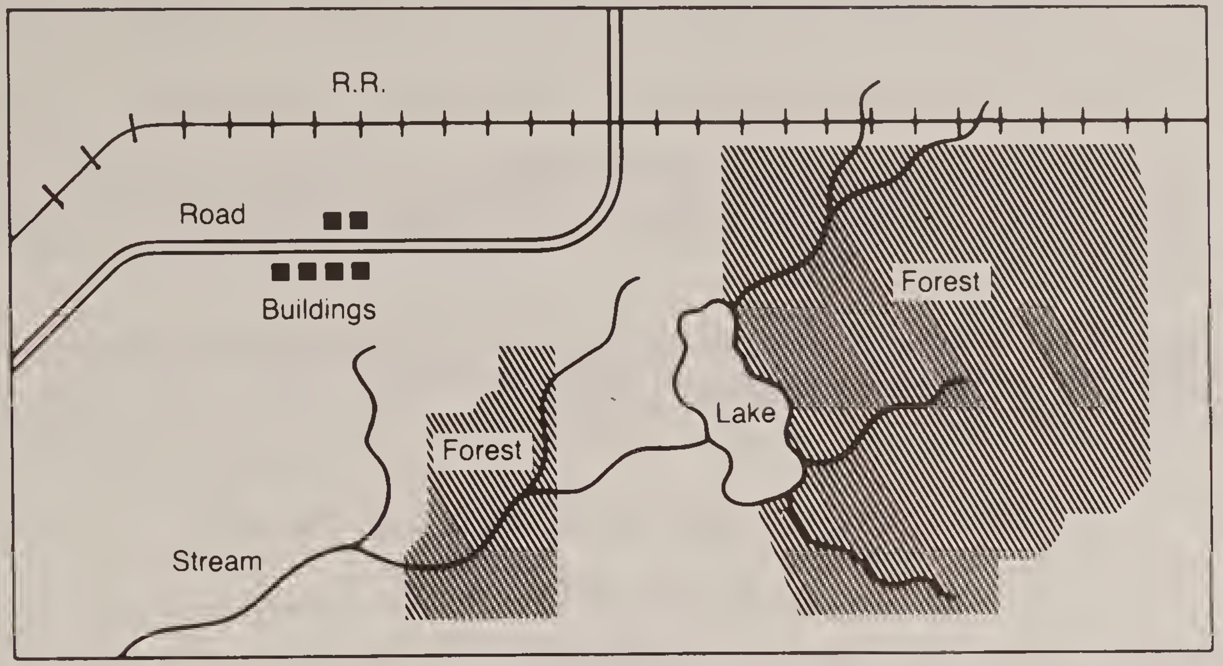


Figure 1.--Map elements showing roads, railroads, buildings, streams, and lake and forest areas.

The codes are based on the cartographic features symbolized on the USGS Topographic Map Series. These maps are the basic source material used to digitize and to encode the data elements, and therefore the map symbology has a strong influence on the overall classification strategy. A listing of all the attribute codes currently assigned and used in 1:24,000- and 1:100,000-scale DLG files is given in Appendix D. Detailed information on how to apply and interpret the attribute coding system is given in Standards for Digital Line Graphs, Part 3: Attribute Coding. (This publication may be purchased from the U.S. Geological Survey. See the ordering information inside the front cover.)

Each attribute code identifies the major category to which a data element belongs, as well as the specific nature of the element. Codes also may provide additional descriptive information. Most elements are uniquely described by a single attribute code. Others, however, may require two or more codes for a complete description. If multiple attributes are needed to describe an element, the order is not usually significant. Allowing for a variable number of attribute codes creates an open-ended structure to which information may be added at any time. It is not necessary for each element to have associated attributes; in general, attribute codes are not assigned to an element if the attributes can be derived based on relationships to adjacent elements. For example, a U.S. Public Land Survey section line is not assigned an attribute code because the line record carries a reference to the areas to the left and right, that will be assigned attribute codes identifying the two different section numbers. The fact that the line is a section line is derivable.

A DLG attribute code is composed of two distinct numeric fields: a three-digit major code, which identifies the major category to which the element belongs, and a four-digit minor code, which specifically describes the element. In the digital file, the major and minor attributes are encoded in two integer fields of six digits, right justified with leading blanks (FORTRAN 2I6 format). In this document, major codes are presented as three digits, and minor codes are presented as four digits. Leading zeros are shown for clarity; for example: 050 0412.

Major Attribute Codes

A list of the major codes and the categories that are currently being collected is contained in table 1. The first two digits of the major code uniquely identify the category to which the described element belongs. The third digit of the major code is used to modify the minor code in two ways:

- If zero, the minor code represents a description or classification of the element.
- If non-zero, the minor code which follows is a parameter requiring special interpretation according to instructions given in the codes for each category (see next section).

Transportation systems have been assigned more than one major code so that their components may be readily separated for analytical applications.

Table 1.--Major codes used for DLG base categories

Major Code	Base Category
020	Hypsography
050[1]	Hydrography
070	Surface Cover
080	Non-Vegetative Surface Features
090	Boundaries
150	Survey Control and Markers
170[2]	Transportation--Roads and Trails
180[2]	Transportation--Railroads
190[2]	Transportation Systems--Pipelines, Transmission Lines, Miscellaneous Transportation Features
200[3]	Other Significant Manmade Structures
300	U.S. Public Land Survey System

[1] Prior to 1983, hydrographic features were digitized as two separate categories, (1) 030-Streams and (2) 040-Water bodies. Hydrographic features are currently digitized as a single category, 050-Hydrography. See Appendix H for a list of hydrographic attribute codes used prior to 1983.

[2] In the last quarter of 1985, the transition was made to these new transportation attribute codes, adding codes for certain miscellaneous transportation features. See Appendix I for a list of transportation attribute codes used prior to this transition.

[3] In the last quarter of 1985, codes for this category were created to replace an earlier version of codes. See Appendix J for a list of the previous attribute codes.

Minor Attribute Codes

The first digit of the minor code is normally zero. If non-zero, it is used as a modifier to provide additional information such as road access or railroad status.

The remaining three digits are normally used to indicate the cartographic interpretation to be applied to specific elements. The type of element described by a particular code usually can be determined from the range of value of the last three digits:

001 - 099 = nodes
100 - 199 = areas
200 - 299 = lines
300 - 399 = degenerate lines
400 - 499 = codes which may be applied to any element type (nodes, lines, areas, or points)
601 - 699 = general descriptive codes

The last three digits (and occasionally all four digits) also may be used as a parameter code. Parameters are used when a minor code can legitimately assume a range of values such as a water elevation or a highway route number. The meaning of a parameter code is indicated by the (non-zero) third digit of the major code.

Sample Attribute Codes

Four examples using the DLG attribute codes follow and should be interpreted with reference to Appendix D.

Example A:

050 0412	The major code 050 indicates the Hydrography category. The minor code 0412 identifies the feature as a stream.

Example B:

170 0201	The major code 170 indicates the Roads and Trails overlay in the Transportation category. The minor code 0201 identifies the feature as a class 1 highway.
170 0603	The major code 170 indicates the Roads and Trails overlay in the Transportation category. The minor code identifies the feature as a road under construction. This code would be used in addition to the code describing the class of road, and would appear in the same record with the code 170 0201.

Example C:

055 0033	The major code 055 indicates a river mile mark for the Hydrography category. Because the last digit of the major code is non-zero, the minor code is a parameter. The minor code 0033 indicates that the value of the river mile mark at that point is 33.

Example D:

306 0033	The major code 306 indicates an Origin of Survey code for the U.S. Public Land Survey System category. Because the last digit of the major code is non-zero, the minor code 0033 indicates that the area element is referenced to the Willamette Meridian.

SAMPLE LINE GRAPH STRUCTURE

Examples of a line graph and its corresponding digital records are given in figure 2 and table 2. These examples are simplified representations of the concepts used in the DLG-3 structure; they are not actual data files. The examples shown are composed of 13 nodes, 5 areas, and 15 lines. The 13 nodes are labeled N1 through N13, the 5 areas are labeled A1 through A5, and the 15 lines are labeled L1 through L15. Each element type is maintained as a separate list in the digital data.

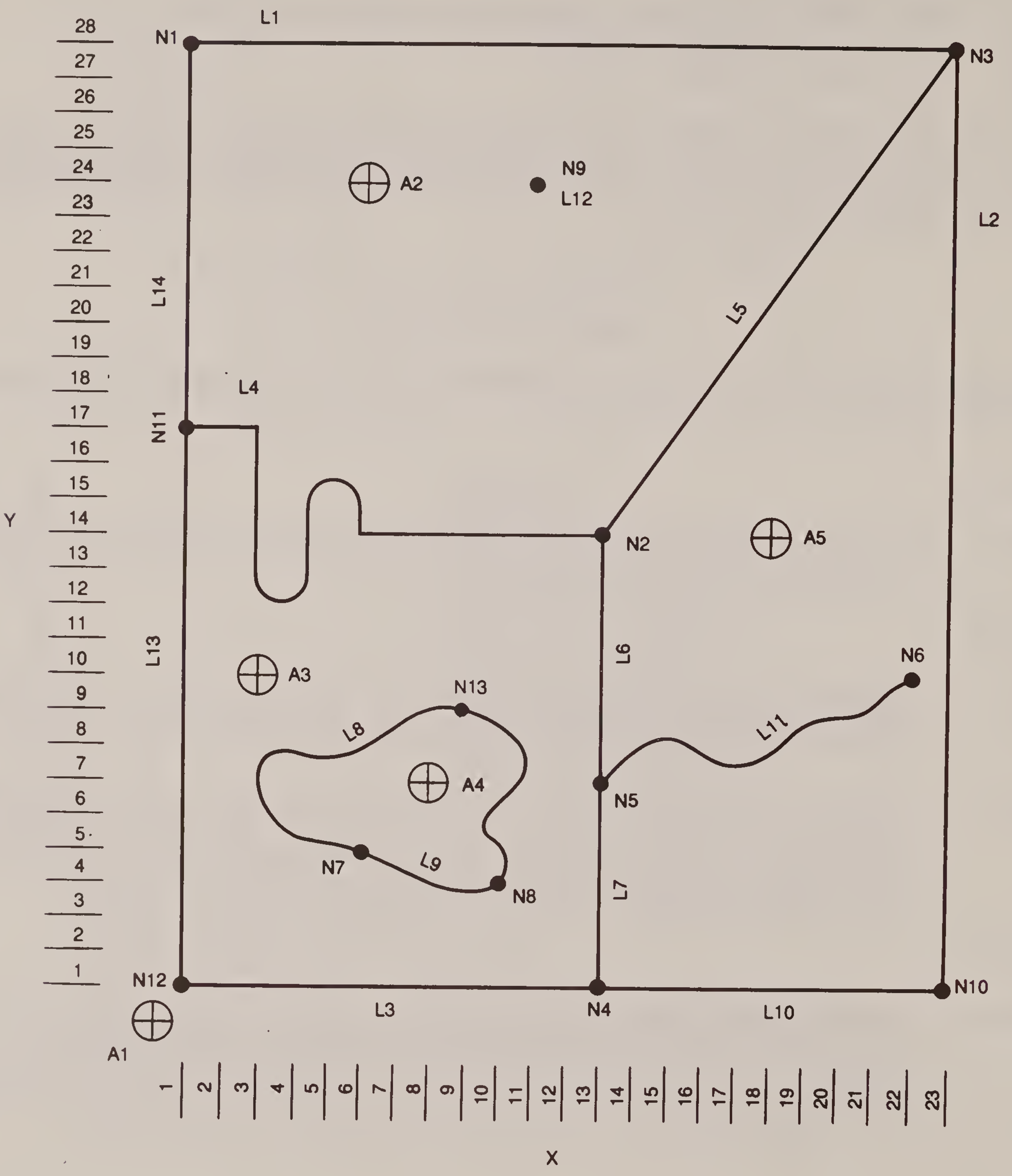


Figure 2.--Sample line graph.

The map represented by the example is divided into five distinct areas labeled Al through A5. Area A1 represents all the area outside of the map border. There is one outside area for each DLG-3. It is always the first area encountered and has the attribute code 000 0000. In the example given in figure 2, the portion of the map inside the border is divided into four areas, each bounded (closed) by lines. Area A2 is bounded by lines L14, L1, L4, and L5. Area A3 is bounded by lines L3, L13, L4, L6, L7, L8, L15, and L9. Area A4 is bounded by lines L8, L15, and L9. Area A5 is bounded by lines L5, L6, L7, and L10 and L2.

In this example, line elements contain the only explicit topological references. Each line contains pointers to its bounding nodes (starting and ending) and the areas that it bounds (left and right of the line).

Table 2.--Digital description of the topological elements and relationships of a sample line graph (see fig. 2)

Nodes

Internal Id Number	X Coordinate	Y Coordinate
N1	1	28
N2	13	14
N3	23	28
N4	13	1
N5	13	7
N6	22	10
N7	6	5
N8	10	4
N9	11	24
N10	23	1
N11	1	17
N12	1	1
N13	9	9

Areas

Internal Id Number	X Coordinate	Y Coordinate
A1	0	0
A2	6	24
A3	3	10
A4	8	7
A5	18	14

Lines

	Nodes		Area		Coordinates	
Number	Starting	Ending	Left	Right	(first x y	last x y)
L1	1	3	1	2	1, 28	23, 28
L2	3	10	1	5	23, 28	23, 1
L3	4	12	1	3	13, 1	1, 1
L4	11	2	2	3	1, 17	13, 14
L5	2	3	2	5	13, 14	23, 28
L6	2	5	5	3	13, 14	13, 7
L7	5	4	5	3	13, 7	13, 1
L8	13	7	4	3	9, 9	6, 5
L9	7	8	4	3	6, 5	10, 4
L10	4	10	5	1	13, 1	23, 1
L11	5	6	5	5	13, 7	22, 10
L12	9	9	2	2	11, 24	11, 24
L13	12	11	1	3	1, 1	1, 17
L14	11	1	1	2	1, 17	1, 28
L15	8	13	4	3	10, 4	9, 9

This format is similar in concept to the standard DLG-3 data structure, which minimizes redundant linkages to achieve efficient data encoding and storage.

The lines in figure 2 are labeled L1 through L15. The lines can be identified by their starting node number, ending node number, number of the area to the left of the direction of travel, number of the area to the right of the direction of travel, and string of coordinates describing the alignment of the line. In this example, only two pairs of coordinates are shown; however, in an actual file, an irregular line would have a variable number of coordinate pairs up to a limit of 3,000 coordinate pairs. The direction of travel of the line is arbitrarily determined during the digitizing operation. In this example, L1 is encoded as proceeding clockwise around area A2. Thus line L1 starts at node N1, ends at node N3, has area A1 to the left of the direction of travel, and has area A2 to the right of the direction of travel. The coordinate string describing the alignment of the line will start with the same coordinate values as that of node N1 and will end with the same coordinate values as that of node N3. Because the area to the left of its direction of travel, A1, is different from the area to the right of its direction of travel, A2, the line is known to be a boundary between the two areas.

Lines L11 and L12 are examples of lines that lie within one area. In this example, line L11 starts at node N5, ends at node N6, has area A5 to the left of the direction of travel, and again has area A5 to the right of the direction of travel. The coordinate string for the line will start with the same coordinate values as that of node N5 and will end with the same coordinate value as that of node N6. Line L12 is an example of a degenerate line. The line starts at node N9, ends at node N9, and has area A2 as both the area to its left and right. There are two coordinate pairs in the string defining the line, and both points have the same coordinate values as node N9; thus, the two points are the same and the line has zero length.

The line graph concept allows all of the points on the map to be described as a member of a line graph element (node, area, or line) with minimal redundancy. The relationships between the various elements are indicated by the structure. Note that in this example the x and y coordinates are numbered from the lower left corner to simplify the drawing. In an actual DLG-3 file, the origin is the center of the map and the internal file coordinates are numbered plus or minus 1 to 32,767 in thousandths of inches. See the section labeled "coordinate systems" for more detail.

GRAPH THEORY IN DLG DATA

The digital line graph concept is based on graph theory, in which a diagram can be expressed as a set of elements (nodes, areas, and lines) in a manner that shows logical spatial relationships with minimal redundancy. There are three ways to implement the line graph concept in DLG files: the area case, the network case, and the area-hybrid case. All NMD files are collected and processed as area-hybrid case DLG's.

Area Case

Area line graphs can be used to represent area features such as political entities or the U.S. Public Land Survey System. In the area case, all closed circuits of lines form unique areas. All line elements bound two different area elements. Line elements for area line graphs are not normally assigned primary attributes. The characteristics of lines in these categories can usually be derived by examining the attributes of the area elements on each side of the line.

Network Case

Network line graphs can be used to represent linear features such as roads, single-line streams, or railroads. The network case differs from the area case in that, irrespective of the number of closed areas forming the graph, only two area elements are encoded: (1) the area outside the graph, termed the outside area; and (2) the area within the graph, termed the background area. All lines except the graph boundary are considered to be contained within the background area. The major topological relationship expressed by network data is that of connectivity. Data encoded in network line graph form are suitable for various forms of network analysis, such as minimum path computations.

Area-Hybrid case

In the area-hybrid case, network and area type information is gathered in a single DLG file. In this approach, all closed circuits of lines define unique areas. However, some lines may exist which do not form boundaries between two areas. The unique areas which represent features for the overlay are given attribute codes. For example, in the hydrography category there are areal features, such as lakes, reservoirs, and swamps, that are represented by unique, attributed area elements. There are also linear features, such as single-line streams and aqueducts, that are significant in themselves and are also assigned attribute codes. These features may occupy a position in an area of no other hydrographic significance, that is, an unattributed background area. Therefore, in processing area-hybrid data, the background area itself is broken into numerous unattributed area records that distinguish the background areas from hydrographic areas. To further illustrate the area-hybrid case, a detailed description of a representative line graph follows.

Figure 3 shows a window taken from the Oneco, Connecticut-Rhode Island, 1:24,000-scale USGS quadrangle map.

Figure 4 shows the line graph encoded for the hydrography of the same area. Certain nodes, areas, and lines are labeled.

Table 3 contains some of the digital data records, extracted from the standard format DLG file, which describe this portion of the graph. The internal sequence identification numbers shown reflect the order of these features in the original file. (Note: Descriptions of DLG-3 formats are contained in Appendixes A and B, and a list of attribute codes is contained in Appendix D.)

In the Oneco example, each node and area element is described by one or two logical records: (1) a type D.1 record that describes the element, and (2) an optional type F record that lists the attribute codes associated with the element. The first record (type D.1) for each node and area element contains the following fields:

1. Type of record indicator, N for node or A for area.
2. Internal sequence identification number.
3. X coordinate of node or representative area point.
4. Y coordinate of node or representative area point.
5. Number of attribute codes that describe the element.
6. Number of pairs of characters in the text string that describes the element.

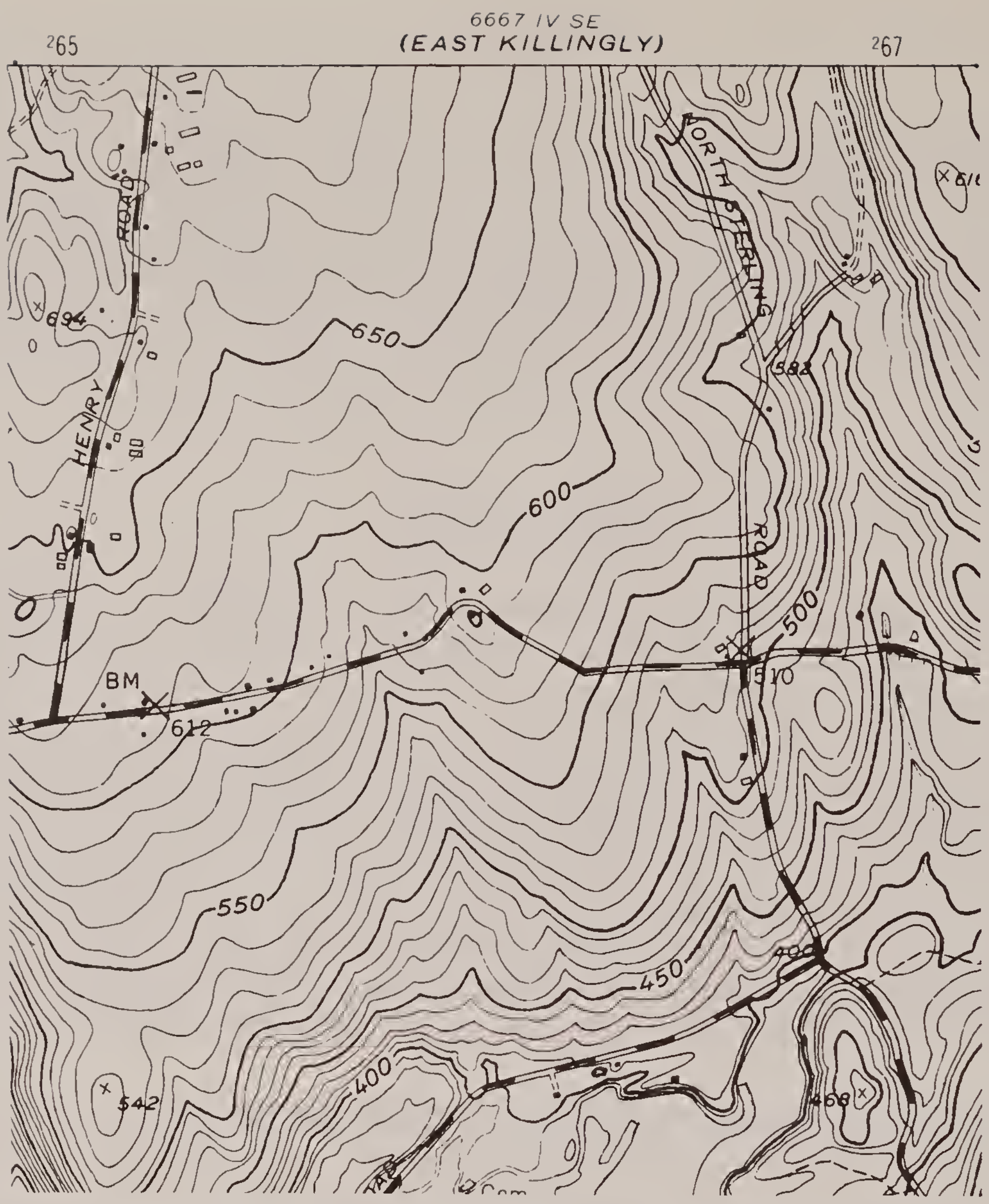


Figure 3.--Window from the Oneco, Connecticut-Rhode Island, 1:24,000-scale quadrangle map.

The second record (type F) for each node and area element contains n attribute codes (expressed as major and minor code pairs), where n is the number specified in field 5 of the first (type D.1) record.

Each line element in the Oneco example is described by two or three logical records: (1) a type D.2 line description record, and (2) a type E record that lists the x,y coordinate pairs that define the shape of the line, and, if appropriate, (3) a type F (attribute code) record. The first record (type D.2) for each line element contains the following fields:

1. Type of record indicator (L).
2. Internal sequence identification number.
3. Internal sequence number of starting node.
4. Internal sequence number of ending node.
5. Internal sequence number of the area to the left of the line.
6. Internal sequence number of the area to the right of the line.
7. Number of x,y coordinate pairs that locate the line on the map.
8. Number of attribute codes that describe the line.
9. Number of pairs of characters in the text string that describes the line.

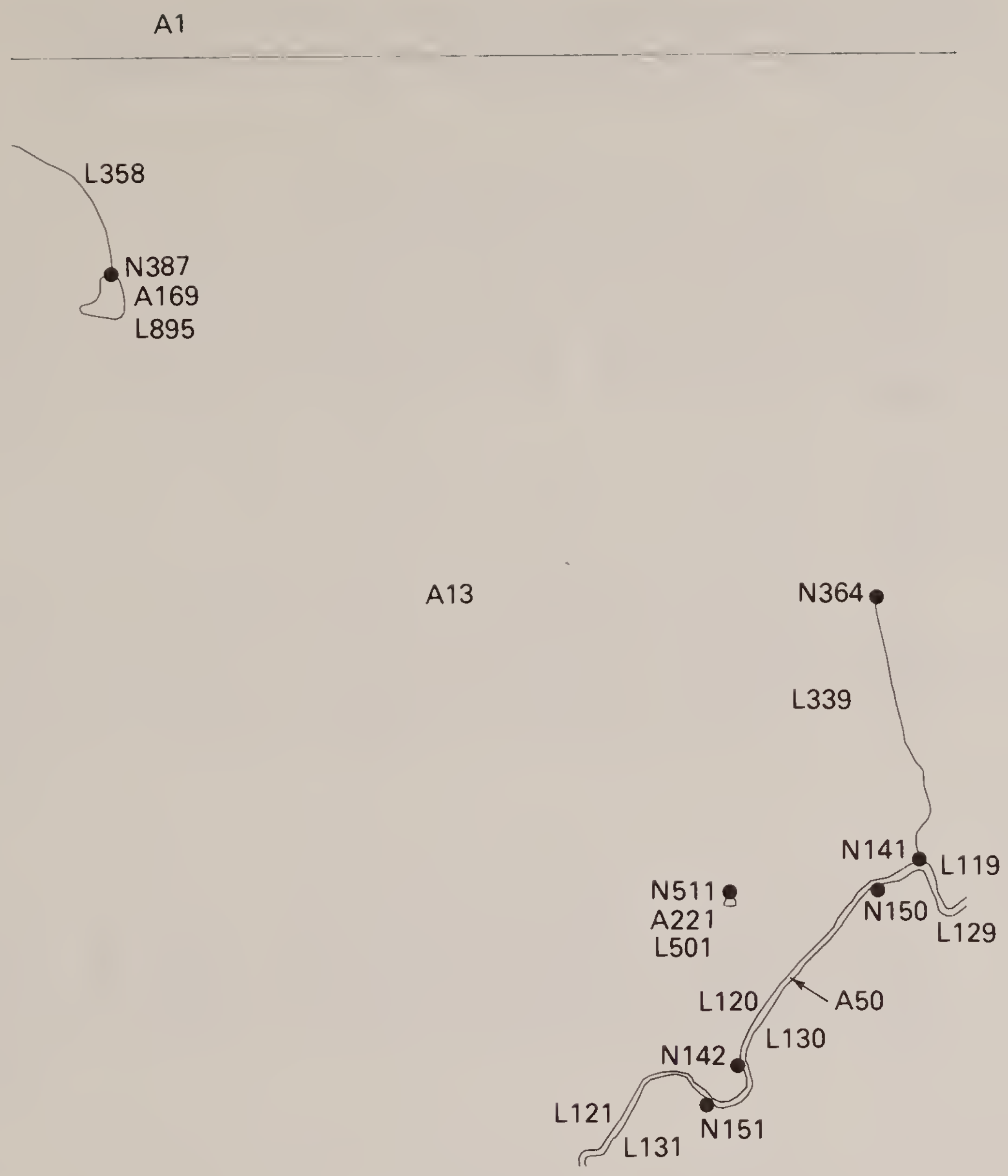


Figure 4.--Window from line graph of hydrography, Oneco, Connecticut Rhode Island, quadrangle.

The second logical record (type E) for each line element contains n coordinate pairs, where n is the number specified in field 7 of the first (type D.2) record. The type F record is as described above.

The records listed in table 3 describe several hydrographic features in the center of the north edge of figure 3, including a portion of Quanduck Brook, a small pond, a swamp, and two small streams. The records referred to in the following description have been extracted from a complete DLG. Therefore, the internal sequence identification numbers shown reflect the order of these features in the original file. The records are referred to in this description by these internal sequence numbers; for example, node 141, area 13, line 119.

Background area 13 has an x,y coordinate of 0,0. This is a result of the processing software automatically determining the numerous background areas within a DLG and assigning these areas an x,y coordinate of 0,0 (which is the origin of a DLG, usually located at the center of a quad). The area outside of the map is represented by area record 1 and is identified by the attribute code 000 0000.

Table 3.--Selected sample of standard format DLG-3 records for Oneco, Connecticut-Rhode Island, Hydrography

---

```
HYDROGRAPHY            2360   808  1180   368  1572  1021

N    141  1654  8143     0     0

N    142   949  7238     0     0

N    150  1501  8058     0     0

N    151   794  7190     0     0

N    364  1484  9210     1     0

   50     1

N    387 -1571 10532     1     0

   50     1

N    511   893  7972     0     0

A      1 -9137   146     1     0

    0     0

A     13     0     0     0     0


A     50 -3179  6522     1     0

   50   412

A    169 -1557 10407     2     0

   50   111    50   613

A    221   893  7991     2     0

   50   421    50     0

L    119   141   140    13    50    26     1     0

  1654  8143  1681  8142  1695  8134  1709  8106  1721  8071  1727  8023
  1758  7963  1765  7956  1785  7958  1856  8012  1954  8106  2008  8162
  2057  8191  2082  8198  2113  8220  2309  8328  2342  8332  2362  8327
  2411  8287  2424  8279  2448  8283  2507  8310  2565  8348  2590  8362
  2638  8391  2655  8406
    50   605

L    120   142   141    13    50    22     1     0

   949  7238   952  7275   926  7357   929  7394   941  7427   972  7490
  1004  7542  1095  7665  1121  7691  1176  7754  1277  7852  1306  7883
  1324  7921  1372  7980  1382  7988  1407  8027  1462  8072  1526  8083
  1558  8100  1620  8137  1641  8144  1654  8143
    50   605
```

Table 3.--Selected sample of standard format DLG-3 records for Oneco, Connecticut-Rhode Island, Hydrography--continued

```
L    121   143   142    13    50    33     1     0

  219  6694   211  6712   211  6745   200  6785   206  6809   223  6821
  264  6825   288  6844   292  6871   285  6907   276  6928   274  6959
  284  6978   300  6990   319  6992   349  6991   363  7001   431  7099
  442  7112   536  7275   563  7290   609  7303   665  7307   717  7296
  731  7281   739  7262   784  7230   816  7195   844  7182   877  7183
  909  7200   937  7225   949  7238
   50   605

L    129   150   139    50    13    33     1     0

 1501  8058  1572  8070  1601  8086  1626  8105  1651  8114  1671  8109
 1685  8081  1707  8020  1718  8001  1731  7950  1743  7938  1765  7927
 1788  7928  1820  7948  1844  7966  1954  8074  2011  8123  2034  9151
 2085  8179  2104  8192  2114  8195  2180  8239  2253  8280  2298  8304
 2321  8313  2345  8312  2359  8305  2400  8269  2424  8263  2452  8266
 2476  8277  2500  8286  2512  8294
   50   606

L    130   151   150    50    13    25     1     0

  794  7190   834  7159   854  7157   903  7169   927  7181   953  7205
  973  7239   975  7259   955  7337   947  7351   952  7390   981  7461
 1008  7492  1065  7577  1107  7645  1143  7679  1162  7697  1193  7741
 1288  7831  1338  7890  1348  7909  1413  7996  1453  8038  1491  8057
 1501  8058
   50   606

L    131   152   151    50    13    36     1     0

   59  6583   109  6597   205  6612   225  6621   239  6637   245  6657
  237  6715   237  6748   222  6775   226  6791   237  6802   278  6809
  315  6835   325  6859   319  6885   313  6900   311  6914   297  6939
  302  6959   313  6967   360  6970   375  6975   394  7004   413  7037
  423  7042   453  7082   510  7183   542  7252   568  7275   638  7291
  670  7295   709  7283   734  7245   767  7213   786  7201   794  7190
   50   606

L    339   364   141    13    13    21     1     0

 1484  9210  1490  9148  1531  8966  1550  8852  1560  8820  1566  8780
 1594  8677  1599  8629  1626  8580  1636  8559  1648  8540  1661  8529
 1673  8510  1675  8450  1698  8376  1701  8350  1690  8318  1643  8261
 1641  8219  1653  8159  1654  8143
   50   412

L    358   387    21    13    13    23     1     0

-1571 10532 -1578 10608 -1597 10705 -1641 10804 -1657 10832 -1683 11865
-1689 10877 -1730 10922 -1769 10946 -1841 10979 -1945 11041 -1979 11049
-2019 11074 -2061 11110 -2080 11131 -2093 11172 -2101 11212 -2109 11230
-2131 11263 -2135 11273 -2143 11280 -2185 11369 -2201 11395
   50   412
```

Table 3.--Selected sample of standard format DLG-3 records
for Oneco, Connecticut-Rhode Island, Hydrography--continued

```
L    501    511    511    221    13     7     2     0

  893  7972    915  7976    912  7997    890  8020    871  7996    864  7974
  893  7972
   50     0     50   200

L    895    387    387    169    13    20     1     0

 -1571 10532 -1586 10532 -1619 10513 -1622 10504 -1622 10454 -1638 10426
 -1655 10415 -1671 10409 -1698 10404 -1707 10392 -1697 10373 -1667 10365
 -1562 10348 -1542 10354 -1526 10373 -1523 10412 -1530 10462 -1543 10503
 -1563 10527 -1571 10532
    50   204
```

The double-line stream, Quanduck Brook, is represented by area record 50 and identified by the attribute code 050 0412 (stream). Area record 13 is the background area on either side of the stream, and as such has no attribute code assigned. Line records 129, 130, and 131 form the left bank of the river, coded as though one were facing downstream. These lines are identified by the attribute code 050 0606 (left bank) and can be chained by referring to the common nodes. Line record 131 begins outside figure 4 and ends at node 151. Line record 130 starts at node 151 and ends at node 150. Line record 129 starts at node 150 and ends outside figure 4.

The right bank of the river is formed in a similar fashion by line records 119, 120, and 121, which are identified by the attribute code 050 0605 (right bank). They are similarly linked through the nodes 141 and 142. Note that the identity of the shoreline as either left or right bank (coded as such to indicate downstream flow) is established by the attribute code, so the given line segments making up the shoreline may be digitized in either direction without altering its identity.

Area record 221 describes the small pond just north of Quanduck Brook. It is identified by two attribute codes: 050 0421 (lake or pond) and 050 0000 (photorevised feature). Its shoreline is formed by line record 501 and identified by the attribute codes 050 0200 (shoreline) and 050 0000 (photorevised feature). This line can be identified as bounding area 221 by the reference within the line record to area 221 being located to the left of the line (indicating that line 501 was digitized counterclockwise).

Area record 169 describes the marsh in the upper-left corner of figure 4. It is identified by two attribute codes: 050 0111 (marsh, wetland, swamp, bog) and 050 0613 (wooded). The perimeter of the swamp is formed by line record 895 and identified by the attribute code 050 0204 (apparent limit). This line can be identified as bounding area 169 by the reference within the line record to area 169 being located to the left of the line (indicating that line 895 was digitized counter-clockwise).

The single-line stream flowing into Quanduck Brook is represented by line record 339 and identified by attribute code 050 0412 (stream). Note that this stream has the same attribute code as the Quanduck Brook (050 0412). This is because both are streams, one of which is digitized as a line and one of which is digitized as an area and its delimiting banks. Line 339 extends from node line and one of which is digitized as an area and its delimiting banks. Line 339 extends from node 364 to node 141. The direction of flow of this stream can be derived from the fact that node 364 is identified with attribute code 050 0001 (upper origin of stream). Background area 13 is located on both sides of the stream.

DISTRIBUTION FORMATS

The 1:24,000-scale and other large-scale DLG data are available in two distribution formats: (1) standard and (2) optional.

The standard distribution format is intended to minimize storage requirements. Explicit topological linkages are contained only in the line elements (starting node, ending node, area to the left of direction of travel, area to the right of direction of travel). A sample DLG in standard format is found in Appendix F.

The optional distribution format was designed to facilitate data usage. The topological relationships explicitly encoded include starting node, ending node, area to the left of direction of travel and area to the right of direction of travel for line elements, bounding lines for area elements, and bounding lines for node elements. These files are typically larger than those in the standard format but, for certain applications, can simplify processing requirements. For example, topological linkages are explicitly encoded for all line, node, and area elements, allowing a polygon data structure to be easily created. These linkages facilitate GIS applications of DLG data as well as generation of graphic products. A sample DLG in optional format is found in Appendix G.

The characteristics of the standard and optional DLG formats are summarized in table 4.

Table 4.--Standard and optional DLG format

	Standard	**Optional**
Character set	8-bit ASCII	8-bit ASCII
Logical record length	144 bytes	80 bytes
Physical record length (blocksize)	Variable in multiples of 144 bytes.	Variable in multiples of 80 bytes.
Coordinate system	Internal file (thousandths of a map inch).	Ground planimetric (UTM).
Topological linkages	Contained only in line elements.	Contained in node, area, and line elements.

These formats are described in detail in Appendixes A and B.

SOURCE MATERIALS

The DLG data files described in this document are derived from USGS topographic maps published as 7.5-minute quadrangles at 1:24,000- or 1:25,000-scale. Where 7.5-minute coverage is not available, the following sources are used, in order of preference:

1. Advance manuscripts for 7.5-minute maps,
2. Published 1:62,500 scale 15-minute quadrangle maps (1:63,360 scale in Alaska), or
3. Archival compilation materials for 15-minute quadrangle maps, if available at a larger scale than the published map, such as 1:48,000 scale.

The scale of the source materials used to generate a DLG is contained in the file header. The scale is also reflected in the resolution field, which states the ground length in meters of the smallest data collection unit (0.001 inch) for each scale.

Source scale	Resolution
1:24,000	0.61 meter
1:25,000	0.635 meter
1:48,000	1.22 meters
1:62,500	1.587 meters
1:63,360	1.61 meters

CELL SIZE AND FILE EXTENT

In general, the DLG's are stored and distributed in standard cells of 7.5 minutes of latitude by 7.5 minutes of longitude. The majority of 1:24,000-scale data collected from 15-minute quadrangles are digitized as four 7.5-minute units. A few older data files collected from 15-minute quadrangles were not digitized in 7.5-minute units, but in 15-minute units.

Nonstandard cells are collected in coastal areas where map format is sometimes extended to conform to the shoreline. It is anticipated that these nonstandard files will eventually be partitioned into standard 7.5-minute by 7.5-minute files.

COORDINATE SYSTEMS

The positional descriptions for DLG data elements are expressed in one of two coordinate systems, dependent upon the distribution format selected. These are described as follows as the standard distribution format and the optional distribution format.

Standard Distribution Format

The DLG data in the standard distribution format are encoded using an internal file coordinate system to minimize storage requirements. The characteristics of this system are as follows:

1. The coordinate system is Cartesian.
2. The origin (x=0, y=0) is normally at the center of the cell.
   Some older files will have their origin below and to the left of the lower left corner of the cell (see fig. 5).

3. The x-axis of the coordinate system is parallel to a theoretical straight line connecting the southwest and southeast corners of the cell; y-axis is perpendicular to that line.
4. One unit is equal to 0.001-inch at map scale.
5. The coordinate domain is limited to the range -32768 to +32767.

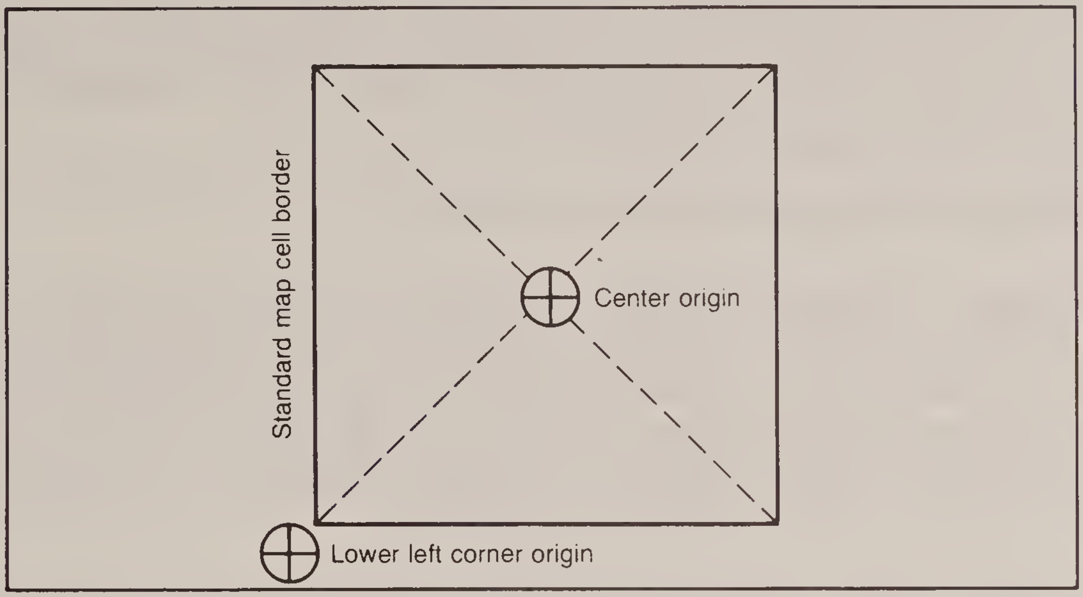


Figure 5.--Location of origin of file reference coordinates.

The file header contains the parameters of a transformation which can be used to convert the internal file coordinates to the ground coordinate system, which is the Universal Transverse Mercator (UTM) for 1:24,000-scale DLG's. An example of this transformation is given in Appendix E.

Optional Distribution Format

The DLG data in the optional distribution format are expressed in the units of the ground coordinate system; that is, meters in the UTM coordinate system.

DATA VALIDATION

The DLG data do not currently carry quantified accuracy statements. The following procedures, however, are used to validate the data files before they are released for distribution:

1. File fidelity and completeness -- The data are either manually digitized using equipment with a resolution of 0.001 inch and an absolute accuracy of from 0.003 to 0.005 inch, or are scanned on an automatic device with a resolution of 30 points per millimeter, or 0.0013 inch. The positional accuracy of the data and completeness of the file are checked by visually comparing proof plots with the original stable-base source material. These proof plots are generated using automated drafting machines with a resolution of 0.001 inch and an absolute accuracy of from 0.003 to 0.005 inch.

2. Attribute accuracy -- DLG attribute codes are checked by software against a table of valid codes to ensure that each attribute in a file is valid for the category and element type to which it is assigned. Validating the codes for correct application is currently a manual process involving the correlation of formatted listings with proof plots.

3. Topological fidelity -- The topological structure of each DLG file is fully validated by software. There are no extraneous intersections; that is, a line does not join or cross another line, or itself, except at a node. No line extends through a node. Polygon (area) adjacency is also validated; that is, area left and right topological attributes of lines are consistent throughout the file. The neatline is free of gaps. Validation of DLG data is performed for each category within a file.

Additional data validation is being implemented as follows:

1. Edge matching -- Validation software provides for checking the edges of each quadrangle against the edges of the four adjacent quadrangles. Each edge of a DLG-3 is checked for positional and attribute matching along the neatlines of the adjoining DLG-3 cells, provided that the surrounding data cells are available at the time the DLG-3 is entered into the NDCDB. There is currently no attempt, other than the coding of coincident features, to provide fully integrated data categories.

2. Quality Control Flags -- Information in the header of the DLG-3 file indicates the status of the file with respect to the edge matching described above. Twelve bytes at the end of record A.1 in the standard distribution format and at the end of record 3 in the optional distribution format of the ASCII file is set aside for quality control flags (see Appendixes A and B). The first three of these flag positions are for future use. The fourth flag position contains a value encoded in the bit pattern that is used only by the database manager to check the edge status. The remaining either flags indicate to the user the edge status code and the status reason code. The four status flags contain the status of the West, North, East, and South edges of a DLG-3 as compared to the edges of the four adjoining DLG-3 files. Each of the four flags is followed by a status reason code that explains the status of the four edges respectively. The possible status values for a DLG-3 entered into the NDCDB are:

   - "b" - unchecked ("b" = blank)
   - "0" - passed edge match test
   - "1" - alignment discontinuity
   - "2" - attribute discontinuity
   - "3" - attribute and alignment discontinuity

   The possible reason codes are:

   - "b" - no reason code set ("b" = blank)
   - "4" - data do not exist
   - "5" - adjacent data cell not currently available for test
   - "6" - discontinuity due to temporal differences in source materials
   - "7" - attribute mismatch valid
   - "8" - paneling unauthorized

A value of "4" indicates that the data cannot be matched because there are no adjacent data. This situation occurs where the quadrangle is on the coast and no adjoining map exists. A reason code with the value of "5" may be reset as the adjoining data cell becomes available for edge match verification. A reason code with the value of "6" means that the adjoining quadrangles were mapped at different times and there are features that do not match in alignment or classification due to the time elapsed between the compilation of the two sets of source materials. A value of "7" indicates that the discrepancy in attribute codes between the two files has been checked and is valid. A reason code with the value of "8" indicates that there was no authorization in place for edge matching at the time the data were archived.

When an edge status code is other than "0", the DLG-3 file will be entered into the NDCDB only when the reason code has also been set as a result of examination of the file.

The following combinations of status flags and reason flags are currently valid for the processing software.

blank, blank   blank, 4   blank, 5   blank, 8
0,blank
1,6   1,7
2,6   2,7
3,6   3,7

APPENDIXES

APPENDIX A.--Standard DLG Distribution Format (Record Contents)

In the standard DLG distribution format, the topological linkages are contained only in the line elements. The files are physically comprised of standard 8-bit ASCII characters organized into fixed-length logical records of 144 characters. Nine distinct record types are defined.

Logical record type	Content
A	Header record containing DLG identification information.
B	Header record containing projection information and registration points.
C	Header record identifying data categories contained in this DLG and indicating the number of nodes, areas, and lines in each category.
D.1	A node or an area record.
D.2	A line record.
E	Record containing x,y coordinate string.
F	Record containing attribute codes.
G	Record containing text string (not currently used).
H	Accuracy estimate (not currently used).

The actual sequence of records in a standard distribution DLG file is as follows:

1. Header records
    - Type A (one record)
    - Type B (one record)
    - Type C (one record)

2. Data records (Repeated for each data category)
    - Node records (Repeated for each node within a data category)
        - Node description (D.1)
        - Attribute codes (F)
        - Text string (G)
    - Area records (Repeated for each area within a data category)
        - Area description (D.1)
        - Attribute codes (F)
        - Text string (G)
    - Line records (Repeated for each line within a data category)
        - Line description (D.2)
        - x,y coordinates (E)
        - Attribute codes (F)
        - Text string (G)

3. Accuracy estimate
    - Type H (one record) (not currently used)

Descriptions of the contents of records A-F are contained in the following tables. The tables also reflect the relationship between these record types and 144-byte logical records.

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

[Integer fields with a value of zero have leading zeros suppressed. Any field with the format of D24.15 which has a value of zero will be represented as "bbb0.0bbbbbbbbbbbbbbbbbb", the last four positions of the fractional portion being reserved for a decimal exponent. (b=blank)]

Logical Record Type A

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
A.1	1	Name of digital cartographic unit	ALPHA	A40	1	40	When practical, the name of the source map followed by the State two-character designator(s).
---	---	Filler	---	---	41	41	1 space
A.1	2	Date of original source materials	ALPHA	A10	42	51	Year of original source material, followed by latest revision date if applicable. For example, 1956, 1965.
A.1	3	Date qualifier	ALPHA	A1	52	52	Qualifier to discriminate revision date, if present. (P=photorevision, I=photo-inspected, L=limited revision)
A.1	4	Scale of original source material	INTEGER*4	I8	53	60	Scale denominator of source material; for example, 24000.
---	---	Filler	---		61	63	3 spaces
A.1	5	Arbitrary quad number	ALPHA	A3	64	66	Quad number assigned for USGS internal use.
		Filler	---	---	67	113	47 spaces

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type A

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
A.1	6	Largest primary contour interval	ALPHA	A4	114	117	Largest primary contour interval, followed by the interval unit (1=feet, 2=meters). Present only if two or more primary contour intervals exist. (Selected overlays.)
A.1	7	Comma	ALPHA	A1	118	118	Comma separator
A.1	8	Largest primary bathymetric contour interval	ALPHA	A4	119	122	Largest primary bathymetric interval, followed by the interval unit (1=feet 2=meters). Present only if two or more primary contour intervals exist.
---	---	Filler					1 space
A.1	9	Smallest primary contour interval	ALPHA	A4	124	127	Smallest or only primary contour interval, followed by the interval unit (1=feet, 2=meters). (Selected overlays.)
A.1	10	Comma	ALPHA	A1	128	128	Comma separator
A.1	11	Smallest primary bathymetric contour interval	ALPHA	A4	129	132	Smallest or only primary bathymetric interval, followed by the interval unit (1=feet, 2=meters).
A.1	12-14	Coded Flags	ALPHA	A1	133	135	3 flags for future use

Logical Record Type A--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
A.1	15	Coded Flag	ALPHA	A1	136	136	Database coded edge flag
A.1	16	EDGEWS	ALPHA	A1	137	137	Status flag for west edge, values are: b = unchecked 0 = passed, 1 = alignment discontinuity, 2 = attribute discontinuity, 3 = attribute and alignment discontinuity.
A.1	17	EDGEWR	ALPHA	A1	138	138	Reason for EDGEWS, values are: b = unchecked, 4 = adjacent data do not exist 5 = adjacent data unavailable, 6 = temporal discontinuity, 7 = attribute mismatch valid, 8 = paneling unauthorized.
A.1	18	EDGENS	ALPHA	A1	139	139	Status flag for north edge, values = b,0,1,2, or 3 as above.
A.1	19	EDGENR	ALPHA	A1	140	140	Reason for EDGENS, values are b,4,5,6,7, or 8 as above.
A.1	20	EDGEES	ALPHA	A1	141	141	Status flag for east edge. Values are b,0,1,2, or 3 as above.
A.1	21	EDGEER	ALPHA	A1	142	142	Reason for EDGEES. Values are b,4,5,6,7, or 8 as above.
A.1	22	EDGESS	ALPHA	A1	143	143	Status flag for south edge. Values are b,0,1,2, or 3 as above.
A.1	23	EDGESR	ALPHA	A1	144	144	Reason for EDGESS. Values are b,4,5,6,7, or 8 as above.

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type A--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
A.2	1	DLG level code	INTEGER*2	I6	1	6	Code=3, DLG-3
A.2	2	Code defining ground planimetric reference system	INTEGER*2	I6	7	12	Code=1, Universal Transverse Mercator (UTM)
A.2	3	Code defining zone in ground planimetric reference system	INTEGER*2	I6	13	18	Codes for UTM coordinate zones are given in Appendix C.
A.2	4	Map projection parameters	REAL*8	5D24.15	19	138	This field contains the first 5 of 15 map projection parameters. Parameters for the UTM projection are given in Appendix C.
---	---	Filler	---	---	139	144	6 spaces
A.3	1	Map projection parameters	REAL*8	6D24.15	1	144	This record contains projection parameters 6 thru 11. Parameters for the UTM projection are given in Appendix C.
A.4	1	Map projection parameters	REAL*8	4D24.15	1	96	This field contains the last 4 projection parameters. Parameters for the UTM projection are given in Appendix C.
A.4	2	Code defining units of measure for ground planimetric coordinates throughout the file	INTEGER*2	I6	97	102	Code=2, meters

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type A--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
A.4	3	Resolution	REAL*8	D24.15	103	126	The true ground distance corresponding to one unit (0.001 inch at map scale) in the file internal reference system. Scale — Resolution 1:24,000 — 0.61 M 1:25,000 — 0.635 M 1:48,000 — 1.22 M 1:62,500 — 1.587 M
A.4	4	Accuracy code of planimetric data	INTEGER*2	I6	127	132	Code=0, unknown accuracy
A.4	5	Number (n) of sides in the polygon which defines the coverage of the cell	INTEGER*2	I6	133	138	n=4
---	---	Filler	---	---	139	144	6 spaces
A.5 A.6	1	A (4,2) array containing geographic coordinates which constitute the registration points for the DLG. In quadrangle-based mapping, these points form a geographic rectangle/square which contains the domain of the DLG.	REAL*8	3(2D24.15) 2D24.15	1 1	144 48	The four registration points will usually coincide with an area defined by one of the standard map formats of the National Mapping Program. Coordinates are in geographic longitude and latitude in units of degrees and decimal degrees and are expressed in the order=SW, NW, NE, SE.
---	---	Filler	---	---	49	144	96 spaces

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type B

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
B.1	1	Parameters (A1, A2, A3, A4) of file-to-ground projection transformation; the explicit form of the transformation is: X=A1x+A2y+A3 Y=A1y-A2x+A4 where: x,y are coordinates in file internal reference system X,Y are coordinates in map projection reference system	REAL*8	4D24.15	1	96	X,Y coordinates resulting from this transformation will be in ground meters in UTM zone defined by data element 3 of record A.2.
B.1	2	Number (m) of registration points	INTEGER*2	I6	97	102	m=4
---	---	Filler	---	---	103	144	42 spaces
B.2	1	A (4,3) array containing identifications and coordinates of registration points. Coordinates are expressed in the file internal reference system.	ALPHA/ INTEGER*2	4(A2, 2I6)	1	56	The corners of a four-sided polygon are used as registration points. The identification sequence is SW, NW, NE, SE. The array is stored by row. Coordinates in the file internal reference system are expressed in units of thousandths of an inch and fall in the range -32768 to +32767. These coordinates correspond to the geographic coordinates contained in records A.5 and A.6.
---	---	Filler	---	---	57	144	88 spaces

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type C

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
C.1	1	Number (q) of categories in the DLG file	INTEGER*4	I6	1	6	The value of q may be from 1 to 32. Up to 32 categories can be represented in a given file. The value will be 1.
---	---	Filler	---	---	7	144	138 spaces
C.2[1] to C.N	1	A (q,7) array containing category names as well as maximum and actual number of node, area, and line elements in each category	ALPHA/ INTEGER*2	q (A20,6I6)	1 (57	56 112)	This array is stored by row. The first element is the category name consisting of 20 alphanumeric characters the first four of which are unique. Columns 2 and 3 of the array contain maximum and actual number of nodes in the category. Columns 4 and 5 contain maximum and actual number of areas in the category. Columns 6 and 7 are the maximum and actual number of line segments. (Note: the maximum number of nodes or areas within a category is 25, 960. The maximum number of lines is 25,938. This field is used only during initial processing of data).
---	---	Filler	---	---	---	144	32 or 88 spaces

[1] The number of categories "q" is given in record C.1. There will be 56 bytes of data per category, and thus a maximum of two categories can be described on a 144-character record. The space filler will vary in size depending on the value of "q."

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type D							
Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
D.1	1	Type of element code	ALPHA	A2	1	2	Code ='Nb' for Node element, 'Ab' for Area element.
D.1	2	Element's internal identification number	INTEGER*2	I6	3	8	Number is positive and sequential from 1-n within each category and element type.
D.1	3	x,y file coordinate of node point or representative point for the area element	INTEGER*2	2I6	9	20	The representative area point is usually, but not always, contained within the area it represents.
D.1	4	Number (t) of attribute codes which are attached to the node or area element (t≥0)	INTEGER*2	I6	21	26	Absence of attribute codes is indicated by t=0.
D.1	5	Number (k) of pairs of text characters which are attached to the node or area element (k≥0)	INTEGER*2	I6	27	32	k=0. Not currently used.
---	---	Filler	---	---	33	144	112 spaces
D.2	1	Code indicating a line segment graph element	ALPHA	A2	1	2	Code='Lb' for line segment.
D.2	2	Line segment's internal identification number	INTEGER*2	I6	3	8	Number is positive and sequential from 1-n within each category and element type.
D.2	3	Internal identification number of starting node	INTEGER*2	I6	9	14	Number refers to data element 2 in record D.1.

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type D--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
D.2	4	Internal identification number of ending node	INTEGER*2	I6	15	20	Number refers to data element 2 in record D.l.
D.2	5	Internal identification number of left area	INTEGER*2	I6	21	26	Number refers to data element 2 in record D.l.
D.2	6	Internal identification number of right area	INTEGER*2	I6	27	32	Number refers to data element 2 in record D.l.
D.2	7	Number (v) of coordinate pairs which define the line segment	INTEGER*2	I6	33	38	The value of v is from 2 to 3000.
D.2	8	Number (t) of attribute codes which are attached to the line segment ($t \geq 0$)	INTEGER*2	I6	39	44	Absence of classification attribute codes is indicated by t=0.
D.2	9	Number (k) of pairs of text characters which are attached to the line segment ($k \geq 0$)	INTEGER*2	I6	45	50	k=0. Not currently used.
	---	Filler	---	---	51	144	94 spaces
E.l to[2] E.n	1	A (v,2) array containing an ordered sequence of coordinate pairs which define the image presentation of a line element	INTEGER*2	v(2I6)	1		Coordinates are expressed in internal file reference system, in units of thousandths of an inch. The array is stored by row.
---	---	Filler	---	---	---	144	0 to 132 spaces

---

[2] The number of coordinate pairs, "v", is given in record D.2. There will be v(2I6) coordinate pairs of which a maximum of 12 pairs will fit on a 144-character ASCII record. The space filler will vary in size depending on the value of "v." If "v" is an integer multiple of 12, there will be no spaces as filler at the end of the record.

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type F

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
F.1[3] to F.n	1	A (t,2) array containing major and minor attribute codes for a graph element	INTEGER* 2	t(2I6)	1		The array is stored by row with the first column containing the major attribute code and the second column containing the minor attribute code.
---	---	Filler	---	---	---	144	0 to 132 spaces

[3] The number of feature (attribute) codes, "t" is given in the D.1 and D.2 records. The F record is an array of t(2I6) codes of which a maximum of 12(2I6) will fit on a 144 character ASCII record. The space filler will vary depending on the value of "t". If "t" is an integer multiple of 12 there will be no spaces as filler at the end of the record.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)

In the optional DLG distribution format, topological linkages are explicitly encoded for node and area elements as well as for line elements. The files are physically comprised of 8-bit ASCII characters organized into fixed-length logical records of 80 characters (bytes). Bytes 1-72 of each record may contain DLG data, and bytes 73-80 may contain a record sequence number.

The 11 distinct record types used in the optional DLG distribution format may be categorized as header and data records.

Four types of records are considered header records:

- File identification and description records
- Accuracy records (not currently used)
- Control-point identification records
- Data-category identification records

Seven types of records are considered data records:

- Node and area identification records
- Node-to-line linkage records
- Area-to-line linkage records
- Line identification records (also contains line-to-node and line-to-area linkages)
- Coordinate string records
- Attribute code records
- Text records (not currently used)

The actual sequence of records in an optional distribution format DLG file is as follows:

1. Header records
    - Ten file identification and description records
    - Accuracy records (not currently used)
    - Control point identification records (one per control-point)
    - Data category identification records (one per data category in the file)

2. Data records

Node identification record Node-to-line linkage record(s) Attribute code record(s) Text record(s)	Repeated for each node within a data category	Repeated for each data category
Area identification record Area-to-line linkage record(s) Attribute code record(s) Text record(s)	Repeated for each area within a data category	
Line identification records Coordinate string record(s) Attribute code record(s) Text record(s)	Repeated for each line within a data category	

Descriptions of the contents of the various types of records in an optional distribution format DLG are contained in the following tables.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

FILE IDENTIFICATION AND DESCRIPTION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte*	Comment
1	1	Banner	ALPHA	A72	1	72	Descriptive text.
2	1	Name of digital cartographic unit	ALPHA	A40	1	40	When practical, the name of the source map followed by the State two-character designators.
---	---	Filler	---	---	41	41	1 space
2	2	Date of original source material	ALPHA	A10	42	51	Year of original source material followed by latest revision date if applicable; for example, 1956, 1965.
2	3	Date qualifier	ALPHA	A1	52	52	Qualifier to discriminate revision date if present. (P=photorevision, I=photo-inspection, L=limited revision).
2	4	Scale of original source material	INTEGER*4	I8	53	60	Scale denominator of source material, for example, 24000.
---		Filler	---		61	63	3 spaces

*The logical record length for the optional distribution format is 80 bytes, with 8 spaces of blank fill in bytes 73-80 of each record which may be used for a record sequence number.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

FILE IDENTIFICATION AND DESCRIPTION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
2	5	Arbitrary quad number (24K files)	ALPHA	---	64	66	Quad number assigned for USGS internal use.
2		Filler	---	---	67	72	6 spaces
3		Filler	---	---	1	41	41 spaces
3	1	Largest primary contour interval	ALPHA	A4	42	45	Largest primary contour interval, followed by the interval unit (1=feet, 2=meters). Present only if two or more primary contour intervals exist. (Selected overlays.)
3	2	Comma	ALPHA	A1	46	46	Comma separator
3	3	Largest primary bathymetric contour interval	ALPHA	A4	47	50	Largest primary bathymetric interval, followed by the interval unit (1=feet, 2=meters, 3=fathoms). Present only if two or more primary intervals exist.
---	---	Filler					1 space
3	4	Smallest primary contour interval	ALPHA	A4	52	55	Smallest or only primary contour interval, followed by the interval unit (1= feet, 2=meters). (Selected overlays.)
3	5	Comma	ALPHA	A1	56	56	Comma separator

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

FILE IDENTIFICATION AND DESCRIPTION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
3	6	Smallest primary bathymetric contour interval	ALPHA	A4	57	60	Smallest or only primary bathymetric interval, followed by the interval unit (1=feet, 2=meters, 3=fathoms).
3	7-9	Coded Flags	ALPHA	A1	61	63	3 flags for future use
3	10	Coded Flag	ALPHA	A1	64	64	Database coded edge flag
3	11	EDGEWS	ALPHA	A1	65	65	Status flag for west edge, values are: b = unchecked, 0 = passed, 1 = alignment discontinuity, 2 = attribute discontinuity, 3 = attribute and alignment discontinuity.
3	12	EDGEWR	ALPHA	A1	66	66	Reason for EDGEWS, values are: b = unchecked, 4 = adjacent data do not exist, 5 = adjacent data unavailable, 6 = temporal discontinuity, 7 = attribute mismatch valid, 8 = paneling unauthorized.
3	13	EDGENS	ALPHA	A1	67	67	Status flag for north edge, values = b,0,1,2, or 3 as above.
3	14	EDGENR	ALPHA	A1	68	68	Reason for EDGENS, values are b,4,5,6,7, or 8 as above.
3	15	EDGEES	ALPHA	A1	69	69	Status flag for east edge Values are b,0,1,2, or 3 as above.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

FILE IDENTIFICATION AND DESCRIPTION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
3	16	EDGEER	ALPHA	A1	70	70	Reason for EDGEES. Values are b,4,5,6,7, or 8 as above.
3	17	EDGESS	ALPHA	A1	71	71	Status flag for south edge. Values are b,0,1,2, or 3 as above.
3	18	EDGESR	ALPHA	A1	72	72	Reason for EDGESS. Values are b,4,5,6,7, or 8 as above.
4	1	DLG level code	INTEGER*2	I6	1	6	Code=3, DLG-3
4	2	Code defining ground planimetric reference system	INTEGER*2	I6	7	12	Code=1, UTM
4	3	Code defining zone in ground planimetric reference system	INTEGER*2	I6	13	18	Codes for UTM coordinate zones are given in appendix C.
4	4	Code defining units of measure for ground planimetric coordinates throughout the file	INTEGER*2	I6	19	24	Code=2, meters
4	5	Resolution	REAL*4	D18.11	25	42	The true ground distance corresponding to one unit (0.001 inch at map scale) in the file internal coordinate system used in data collection. Scale — Resolutions 1:24,000 — 0.61 M 1.25,000 — 0.635 M 1:48,000 — 1.22 M 1:62,500 — 1.587 M

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

FILE IDENTIFICATION AND DESCRIPTION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
4	6	Number of file-to-map transformation parameters	INTEGER*2	I6	43	48	Usually 4.
4	7	Number of accuracy/ miscellaneous records	INTEGER*2	I6	49	54	Currently=0, none included
4	8	Number (n) of sides in the polygon which define the coverage of the cell. Number (n) also defines the number of control-points	INTEGER*2	I6	55	60	n = 4.
4	9	Number (q) of categories in the DLG file	INTEGER*2	I6	61	66	Value of q may be from 1 to 32. The value will be 1.
---	---	Filler	---	---	67	72	6 spaces
5-9	1	Projection parameters for map transformation	REAL*8	3D24.15	1	72	Three parameters on each of 5 records. Parameters for the UTM projection are given in Appendix C.
10	1	Internal file-to-map projection transformation parameters	REAL*4	4D18.11	1	72	A transformation of this type is not required, since coordinates are expressed in a ground planimetric coordinate system (usually UTM). These parameters are however, valid for transformation as described in record B.1, data element 1, of the standard format.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

CONTROL-POINT IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1-n	1	Control-point label	ALPHA	A2	1	2	"SW," "NW," "NE," or "SE" for four quadrangle corners.
		Filler			3	6	4 spaces
	2	Latitude	REAL*4	F12.6	7	18	In degrees and decimal degrees.
	3	Longitude	REAL*4	F12.6	19	30	In degrees and decimal degrees.
		Filler			31	36	6 spaces
	4	X coordinate	REAL*4	F12.2	37	48	In units in the appropriate zone of the ground planimetric coordinate system.
	5	Y coordinate	REAL*4	F12.2	49	60	In units in the appropriate zone of the ground planimetric coordinate system.
---	---	Filler	---	---	61	72	12 spaces

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

DATA CATEGORY IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1-q	1	Category name	ALPHA	A20	1	20	The first 4 characters are unique.
	2	Attribute format codes	INTEGER*2	I4	21	24	Blank or zero (0) indicates default (2I6) attribute formatting in major-minor pairs.
	3	Number of nodes referenced in file	INTEGER*2	I6	25	30	Number of nodes referenced in file as start and end nodes of lines.
	4	Actual number of nodes in file	INTEGER*2	I6	31	36	Only if some or all node records were excluded from the file, would this number be different from data element 3.
		Filler	---	---	37	37	1 space
	5	Presence of node-to-area linkage records	INTEGER*2	I1	38	38	Flag=0, node-to-area linkage records not present.[1]
	6	Presence of node-to-line linkage records	INTEGER*2	I1	39	39	Flag=1, node-to-line linkage records are included.[1]
	---	Filler	---	---	40	40	1 zero or space
	7	Number of areas referenced in file	INTEGER*2	I6	41	46	Number of areas referenced in file as areas left and areas right of lines.

---

[1] The flags for lists present or absent are the current default values, and are the only current values used.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

DATA CATEGORY IDENTIFICATION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1-q	8	Actual number of areas in file	INTEGER*2	I6	47	52	Only if some or all area records were excluded from the file would the number be different from the data element 7.
	---	Filler	---	---	53	53	1 space
	9	Presence of area-to-node linkage records	INTEGER*2	I1	54	54	Flag=0, area-to-node linkage records not present.[1]
	10	Presence of area-to-line linkage records	INTEGER*2	I1	55	55	Flag=1, area-to-line linkage records are included.[1]
	11	Presence of area-coordinate lists	INTEGER*2	I1	56	56	Flag=0, area-coordinate lists not present.[1]
	12	Number of lines referenced in file	INTEGER*2	I6	57	62	Number of lines referenced in area-to-line and node-to-line records.
	13	Actual number of lines in file	INTEGER*2	I6	63	68	Only if some lines were excluded from the file would this number be different from data element 12.
	---	Filler	---	---	69	71	3 spaces
	14	Presence of line-coordinate lists	INTEGER*2	I1	72	72	Flag=1, line-coordinate lists are included.[1]

---

[1] The flags for lists present or absent are the current default values, and are the only current values used.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

NODE AND AREA IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
	1	Record type	ALPHA	A1	1	1	"N" or "A"
	2	Element internal ID number	INTEGER*2	I5	2	6	This number is positive and sequential from 1-n within each category and element type.
	3	Coordinates of node point or representative point for area	REAL*4	2F12.2	7	30	The area point is usually, but not always within the polygon it represents.
	4	Number of elements in an area list (for nodes), or in a node list (for areas)	INTEGER*2	I6	31	36	Blank or zero (0). These lists are not currently included.
	5	Number of elements in line segment list	INTEGER*2	I6	37	42	Number of line segments that intersect at the node, or bound the area.
	6	Number of x,y or lat-long points in area-coordinate list	INTEGER*2	I6	43	48	Blank or zero (0). These lists are not currently included.
	7	Number of attribute codes listed	INTEGER*2	I6	49	54	Number of attribute codes listed.
	8	Number of text characters listed	INTEGER*2	I6	55	60	Zero (0). There are no text attributes for 7.5- and 15-minute DLG data.
	9	Number of islands within area	INTEGER*2	I6	61	66	Area records only, 6 spaces for node records.
---	---	Filler	---	---	67	72	6 spaces

NODE-TO-LINE LINKAGE RECORDS

FORTRAN FORMAT (12I6), for each node: The list consists of line segment internal ID numbers (which appear in bytes 2-6 of the line identification records). The line segments which begin at this node are included in the list as positive ID numbers. The line segments which terminate at this node are included as negative ID numbers. There is no logical order to the list.

AREA-TO-LINE LINKAGE RECORDS

FORTRAN format (12I6), for each area: The list consists of line segment internal ID numbers (which appear in bytes 2-6 of the line identification records) and, for those areas with islands (indicated by bytes 61-66 of the area's first record), zero (0) elements marking the beginning of islands. Line segments with this area to the right are included as positive ID numbers. Line segments with this area to the left are included as negative ID numbers. The list is ordered clockwise around the perimeter of the area and counterclockwise around each island, if any (counterclockwise around an island of an area is still a clockwise direction in reference to the area itself). A zero (0) element is inserted in the list before each island sublist.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

LINE IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
	1	Record type		A1	1	1	"L"
	2	Element internal ID number		I5	2	6	This number is positive and sequential from 1-n within each category and element type.
	3	Starting node		I6	7	12	Internal ID number. This refers to data element 2 of the node identification record.
	4	Ending node		I6	13	18	Internal ID number. This refers to data element 2 of the node identification record.
	5	Left area		I6	19	24	Internal ID number. This refers to data element 2 of the area identification record.
	6	Right area		I6	25	30	Internal ID number. This refers to data element 2 of the area identification record.
	---	Filler		---	31	42	12 spaces
	7	Number of x,y coordinates listed		I6	43	48	Number of coordinate pairs listed.
	8	Number of attribute codes listed		I6	49	54	Number of attribute codes (or two element attribute pairs) listed.
	9	Number of text characters listed		I6	55	60	Zero (0). There are no text data associated with 7.5- and 15-minute DLG data.

COORDINATE STRING RECORDS

FORTRAN format (3(2F12.2)): The coordinates are in appropriate units in the designated ground planimetric coordinate system (usually meters in UTM). The file-to-map projection parameters in Header record 10 are set to (1.0,0.0,0.0,0.0) for real map projection coordinates (the transformation formulas still apply).

CODE RECORDS

As major-minor code attribute pairs, FORTRAN format (6(2I6)): Within each pair, the first integer is the major code and the second integer is the minor code. Each major and minor code is a one-to-four-digit integer, right justified within the six-byte field.

APPENDIX C.--Map Projection Parameters Universal Transverse Mercator (UTM)

The standard and optional DLG distribution formats include 15 fields reserved for map projection parameters. These parameters are typically used as input for a coordinate transformation package such as the USGS General Cartographic Transformation Package (GCTP).

When the ground coordinate system of a DLG is the Universal Transverse Mercator system, as in the case for all DLG's digitized from 1:24,000scale maps, only the first two of the 15 parameter fields are used:

1. Longitude of any point in UTM zone. Normally placed at the
2. Latitude of any point in UTM zone. center of the DLG cell.
3-15. Not used (=0).

A transformation to or from UTM using GCTP can be controlled by specifying the UTM zone or by supplying the geographic coordinate in parameters 1 and 2, from which the UTM zone is computed by GCTP. In a DLG file, the parameters are encoded as packed, degrees-minutes-seconds (DMS) as follows:

degrees * 1000000 + minutes * 1000 + seconds

Example: If degrees = +50, minutes = 30, and seconds = 36.25, then the parameter value is 50030036.25 stored as a REAL*8 variable, and "bbb0.500300362500000D 08" encoded in FORTRAN D24.15 format.

Codes for UTM Coordinate Zones

West Longitude (degrees)	Zone
180-174	1
174-168	2
168-162	3
162-156	4
156-150	5
150-144	6
144-138	7
138-132	8
132-126	9
126-120	10
120-114	11
114-108	12
108-102	13
102- 96	14
96- 90	15
90- 84	16
84- 78	17
78- 72	18
72- 66	19
66- 60	20

APPENDIX D.--DLG Attribute Codes

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Hypsography	Feature identification	Nodes	020	NONE	
		Areas	020	0100	Void area
		Lines	020	0200	Contour (index or intermediate)
				0201	Carrying contour
				0202	Supplementary contour
				0203	Continuation contour
				0204	Auxiliary contour
				0205	Bathymetric contour
				0206	Depth curve
				0207	Watershed divides
				0299	Processing line
		Points (degenerate lines)	020	0300	Spot elevation, less than third order
			020	0301	Spot elevation, less than third order, not at ground level
		Multiple element types	020	NONE	
	Descriptive	Multiple element types	020	0600-0609	Decimal fractions of feet or meters
				0610	Approximate
				0611	Depression
				0612	Glacier or snow field
				0613	Underwater
				0614	Best estimate of contour elevation value
			020	0000	Photorevised feature
	Parameter	Multiple element types	02N	----	Elevation in whole feet or meters, right-justified
			029	00--	Coincident feature

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Hydrography	Feature identification	Nodes	050	0001	Upper origin of stream
				0002	Upper origin of stream at water body
				0003	Sink, channel no longer evident
				0004	Stream entering water body
				0005	Stream exiting water body
		Areas	050	0100	Alkali flat
				0101	Reservoir
				0102	Covered reservoir
				0103	Glacier or permanent snowfield
				0104	Salt evaporator
				0105	Inundation area
				0106	Fish hatchery or farm
				0107	Industrial water impoundment
				0108	Area to be submerged
				0109	Sewage disposal pond or filtration beds
				0110	Tailings pond or settling basin
				0111	Marsh, wetland, swamp, bog
				0112	Mangrove area
				0113	Rice field
				0114	Cranberry bog
				0115	Flats (tidal, mud, sand, gravel)
				0116	Bays, estuaries, gulfs, oceans, seas
				0117	Shoal
				0118	Soda evaporator
				0119	Duck Pond
		Lines	050	0200	Shoreline
				0201	Manmade shoreline
				0202	Closure line
				0203	Indefinite shoreline
				0204	Apparent limit
				0205	Outline of a Carolina bay
				0206	Danger curve
				0207	Apparent shoreline
				0208	Sounding datum
				0209	Low water line
				0299	Processing line

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Hydrography (cont'd.)	Feature identification	Points (degenerate lines)	050	0300	Spring
				0301	Non-flowing well
				0302	Flowing well
				0303	Riser
				0304	Geyser
				0305	Windmill
				0306	Cistern
		Multiple element types	050	0400	Rapids
				0401	Falls
				0402	Gravel pit or quarry filled with water
				0403	Gaging station
				0404	Pumping station
				0405	Water intake
				0406	Dam or weir
				0407	Canal lock or sluice gate
				0408	Spillway
				0409	Gate (flood, tidal, head, check)
				0410	Rock
				0411	Crevasse
				0412	Stream
				0413	Braided stream
				0414	Ditch or canal
				0415	Aqueduct
				0416	Flume
				0417	Penstock
				0418	Siphon
				0419	Channel in water area
				0420	Wash or ephemeral drain
				0421	Lake or pond
				0422	Coral reef
				0423	Sand in open water
				0424	Spoil area
				0425	Fish ladders
				0426	Holiday area

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Hydrography (cont'd.)	Descriptive	Multiple element types	050	0601	Underground
				0602	Overpassing
				0603	Elevated
				0604	Tunnel
				0605	Right bank
				0606	Left bank
				0607	Under construction
				0608	Salt
				0609	Unsurveyed
				0610	Intermittent
				0611	Abandoned or discontinued
				0612	Submerged or sunken
				0613	Wooded
				0614	Dry
				0615	Mineral or hot (sulphur, alkali, etc.)
				0616	Navigable, transportation
				0617	Underpassing
				0618	Earthen construction
				0621-0629	Decimal fractions in feet or meters
			050	0000	Photorevised feature
	Parameter	Multiple element types	05N	----	Water surface elevation N=1 for feet, 2 for meters, 6 for feet below datum, and 7 for whale meters below datum. Elevation value in four spaces, right justified.
			053	0---	Angle of clockwise rotation (nearest whole degree)
			055	----	River mile, value in four spaces, right justified
			058	0000	Best estimate of classification or position
			059	00--	Coincident feature

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Vegetative Surface Cover	Feature identification	Nodes	070	NONE	
		Areas	070	0101	Woods or brushwood
				0102	Scrub
				0103	Orchard or plantation
				0104	Vineyard
				0105	Scattered trees
		Lines	070	0200	Closure line
			070	0299	Processing line
		Points	070	NONE	
		Multiple element types	070	NONE	
	Descriptive	Multiple element types	070	0000	Photorevised feature
	Parameter	Multiple element types	078	0000	Best estimate of position or classification
			079	00--	Coincident feature
Nonvegetative Features	Feature identification	Nodes	080	NONE	
		Areas	080	0100	Glacial moraine
				0101	Gravel beach
				0102	Sand beach
				0103	Shifting sand or dune area
				0104	Lava
		Lines	080	0299	Processing line
		Points (degenerate lines)	080	0300	Located surface feature

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Nonvegetative Features (cont'd.)	Feature identification (cont'd.)	Multiple element types	080	NONE	
	Descriptive	Multiple element types	080	0000	Photorevised feature
	Parameter	Multiple element types	088	0000	Best estimate of position or classification
			089	00--	Coincident feature
Boundaries	Feature identification	Nodes	090	0001	Monumented point on a boundary
		Areas	090	0100	Civil township, district, precinct, or barrio
				0101	Incorporated city, village, town, borough, or hamlet
				0103	National park, monument, lakeshore, seashore, parkway, battlefield, or recreation area
				0104	National forest or grassland
				0105	National wildlife refuge, game preserve, or fish hatchery
				0106	National scenic waterway, riverway, wild and scenic river, or wilderness area
				0107	Indian reservation
				0108	Military reservation
				0110	Federal prison
				0111	Miscellaneous Federal reservation
				0129	Miscellaneous State reservation
				0130	State park, recreation area, arboretum, or lake
				0131	State wildlife refuge, game preserve, or fish hatchery
				0132	State forest or grassland
				0133	State prison
				0134	County game preserve
				0135	Ahupuaa (Hawaii)
				0136	Homestead (Hawaii)

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Boundaries (cont'd.)	Feature identification (cont'd.)	Areas (cont'd.)	090	0150	Large park (city, county, or private)
				0151	Small park (city, county, or private)
				0197	Canada
				0198	Mexico
				0199	Open water
		Lines	090	0201	Indefinite (or approximate) boundary
				0202	Disputed boundary
				0203	Historical line
				0204	Boundary closure line
				0299	Processing line
		Points (degenerate lines)	090	0301	Reference monuments for boundary points
		Multiple element types	090	NONE	
	Descriptive	Multiple element types	090	0000	Photorevised feature
	Parameter	Multiple element types	091	00--	State or state equivalent FIPS code
			092	0---	County or county equivalent FIPS code
			095	----	Monument number
			099	00--	Coincident feature
Survey Control and Markers	Feature identification	Nodes	150	0300-0332	Node elements only when located on a closure line otherwise points (degenerate lines)
		Areas	150	0100	Void area
		Lines	150	0200	Closure line
		Points (degenerate lines)	150	0300	Horizontal control station, third order or better, permanent mark
				0301	Horizontal and vertical control station, third order or better
				0302	Horizontal control station, vertical angle bench mark (VABM)

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Survey Control and Markers (cont’d.)	Feature identification (cont’d.)	Points (degenerate lines)		0303	Horizontal control station, checked spot elevation
				0310	Vertical control station, third order or better, tablet
				0311	Vertical control station, recoverable mark, third order or better, no tablet
				0320	Boundary monument, third order or better, tablet
				0321	Boundary monument, third order or better, no tablet
				0330	Reference monument
				0331	U.S. Mineral or location monument
				0332	Other control point
		Multiple element types		NONE	
	Descriptive	Multiple element types	150	0000	Photorevised feature
			150	0601-0609	Fractions of elevation values
	Parameter	Multiple element types	151	----	State or state equivalent FIPS code
			152	----	County or county equivalent FIPS code
			153	----	Elevation in feet
			154	----	Elevation in meters
			156	----	Elevation minus 10,000, for elevations greater than 9,999 feet
			159	00--	Coincident feature
Transportation, Roads and Trails	Feature identification	Nodes	170	0001	Bridge abutment
				0002	Tunnel portal
				0004	Gate
				0005	Cul-de-sac
				0006	Dead end
				0007	Drawbridge

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Transportation, Roads, and Trails (cont'd.)	Feature identification (cont'd.)	Areas	170	0100	Void area
		Lines	170	0201	Primary route, class 1, symbol undivided
				0202	Primary route, class 1, symbol divided by centerline
				0203	Primary route, class 1, divided, lanes separated
				0204	Primary route, class 1, one way, other than divided highway
				0205	Secondary route, class 2, symbol undivided
				0206	Secondary route, class 2, symbol divided by centerline
				0207	Secondary route, class 2, symbol divided, lanes separated
				0208	Secondary route, class 2, one way, other then divided highway
				0209	Road or street, class 3
				0210	Road or street, class 4
				0211	Trail, class 5, other than four-wheel-drive vehicle
				0212	Trail, class 5, four-wheel-drive vehicle
				0213	Footbridge
				0214	Road ferry crossing
				0215	Perimeter of parking area
				0216	Arbitrary extension of line (join or closure)
				0217	Road or street, class 3, symbol divided by centerline
				0218	Road or street, class 3, divided lanes separated
				0219	Road or street, class 4, one way
				0220	Closure line
				0221	Road or street, class 3, one way
				0222	Road in transition
				0299	Processing line
		Points (degenerate lines)		NONE	

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Transportation, Roads, and Trails (cont'd.)	Feature identification (cont'd.)	Multiple element types	170	0401	Traffic circle
				0402	Cloverleaf or interchange
				0403	Toll gate, toll plaza or perimeter of toll plaza
				0404	Weigh station
				0405	Nonstandard section of road
	Descriptive	Multiple element types	170	0601	In tunnel
				0602	Overpassing, on bridge
				0603	Under construction, classification known
				0604	Under construction, classification unknown
				0605	Labeled "old railroad grade"
				0606	Submerged or in ford
				0607	Underpassing
				0608	Limited access
				0609	Toll road
				0610	Privately operated or controlled public access
				0611	Proposed
				0612	Double-decked
				0613	In service facility or rest area
				0614	Elevated
				0615	Bypass route
				0616	Alternate route
				0617	Business route
				0618	On drawbridge
				0619	Spur
				0620	Loop
				0621	Connector
				0622	Truck route
				0650	Road width 46-55 feet, 0.025 inches at 1:24,000
				0651	Road width 56-65 feet, 0.030 inches at 1:24,000
				0652	Road width 66-75 feet, 0.035 inches at 1:24,000

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Transportation, Roads, and trails (cont'd.)	Descriptive (cont'd.)	Multiple element types (cont'd.)	170	0653	Road width 76-85 feet, 0.040 inches at 1:24,000
				0654	Road width 86-95 feet, 0.045 inches at 1:24,000
				0655	Road width 96-105 feet, 0.050 inches at 1:24,000
				0656	Road width 106-115 feet, 0.055 inches at 1:24,000
				0657	Road width 116-125 feet, 0.060 inches at 1:24,000
				0658	Road width 126-135 feet, 0.065 inches at 1:24,000
				0659	Road width 136-145 feet, 0.070 inches at 1:24,000
			170	0000	Photorevised feature
	Parameter	Multiple element types	171	----	Number of lanes
			172	----	Interstate route number
			173	----	U.S. route number
			174	----	State route number
			175	----	Reservation, park, or military route number
			176	----	County route
			177	XXYY	Alphabetic portion of any route number. Substitute numeric equivalent of alphabetic for XX and for YY as follows: 00 = blank, 01 = A, 02 = B, 03 = C, 04 = D, 05 = E, 06 = F, 07 = G, 08 = H, 09 = I, 10 = J, 11 = K, 12 = L, 13 = M, 14 = N, 15 = O, 16 = P, 17 = Q, 18 = R, 19 = S, 20 = T, 21 = U, 22 = V, 23 = W, 24 = X, 25 = Y, 26 = Z.

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Transportation, Roads, and Trails (cont'd.)	Parameter (con't.)	Multiple element types (cont'd.)	178	0000	Best estimate of position or classification
			179	00--	Coincident feature
Transportation, Railroads	Feature identification	Nodes	180	0001	Bridge abutment
				0002	Tunnel portal
				0007	Drawbridge
		Areas	180	0100	Void area
		Lines	180	0201	Railroad
				0202	Railroad in street or road
				0204	Carline
				0205	Cog railroad, incline railway, logging tram
				0207	Railroad ferry crossing
				0208	Railroad siding
				0209	Perimeter or limit of yard
				0210	Arbitrary line extension (join, closure)
				0299	Processing line
		Points (degenerate lines)	180	NONE	
		Multiple element types	180	0400	Railroad station, perimeter of station
				0401	Turntable
				0402	Roundhouse
	Descriptive	Multiple element types	180	0601	In tunnel
				0602	Overpassing, on bridge
				0603	Abandoned
				0604	Dismantled
				0605	Underpassing
				0606	Narrow gauge
				0607	In snowshed or under structure
				0608	Under construction

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Transportation, Railroads (cont'd.)	Descriptive (cont'd.)	Multiple element types (cont'd.)	180	0609	Elevated
				0610	Rapid transit
				0611	On drawbridge
				0612	Private
				0613	U.S. Government
				0614	Juxtaposition
			180	0000	Photorevised feature
	Parameter	Multiple element types	181	----	Number of tracks
			183	0---	Angle of clockwise rotation (nearest whole degree)
		types	188	0000	Best estimate of position or classification
			189	00--	Coincident feature
Transportation, Pipelines, Transmission Lines, Miscellaneous Transportation Features	Feature identification	Nodes	190	0001	End of transmission line at power station, substation, or hydroelectric plant
				0002	End of pipeline at oil or gas field
				0003	End of pipeline at refinery, depot, or tank farm
		Areas	190	NONE	
		Lines	190	0201	Pipeline
				0202	Power transmission line
				0203	Telephone or telegraph line
				0204	Aerial tramway, monorail, ski lift
				0205	Arbitrary extension closure line
		Points (degenerate lines)	190	0300	Seaplane anchorage
		Multiple element types	190	0400	Power station
				0401	Substation
				0402	Hydroelectric Plant

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Transportation, Pipelines, Transmission Lines, Miscellaneous Transportation Features (cont'd.)	Feature Identification (cont'd.)	Multiple element types (cont'd.)	190	0403	Landing strip, airport, perimeter of airport
				0404	Heliport, perimeter of heliport
				0405	Launch complex, perimeter of launch complex
				0406	Pumping station (other than water)
				0407	Seaplane ramp or landing area
				0408	Measuring station, valve station
	Descriptive	Multiple element types	190	0600	Underground
				0601	Under construction
				0602	Abandoned
				0603	Above ground
				0604	Labeled "closed"
				0605	Unimproved, loose surface
				0606	Submerged
				0607	Nuclear
			190	0000	Photorevised feature
	Parameters	Multiple element types	193	0---	Angle of clockwise rotation (nearest whole degree)
			198	0000	Best estimate of position or classification
			199	00--	Coincident feature
Manmade Features	Feature identification	Nodes	200	NONE	
		Areas	200	0100	Church complex (convent, retreat, etc.)
				0101	School campus (university, college, etc.)
				0102	Hospital complex (sanatorium, nursing home, etc.)
				0103	Orphanage

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Manmade Features (cont'd.)	Feature identification (cont'd.)	Areas (cont'd.)	200	0104	Prison compound
				0105	Trailer park
				0120	Ski area
				0122	Athletic field
				0123	Golf course
				0124	Shopping center
				0125	Zoo
				0126	Drive-in theater
				0127	Race track, raceway
				0128	Playground
				0140	Marina
				0141	Cable area
				0150	Built-up, urban, or house-omission area
				0160	Industrial park
				0161	Materials storage area
				0162	Refinery or industrial plant
				0163	Tailings
				0164	Intricate surface area
				0165	Oil sump or sludge pit
				0180	Tank farm
				0181	Feedlot
				0182	Experimental farm
				0183	Proving grounds
				0184	Firing range
				0190	Void area
		Lines		0200	Conveyor
				0201	Boardwalk
				0202	Wall
				0203	Sea wall
				0206	Fence line
				0207	Flume (nonwater)
				0209	Sewer line
				0211	Coke ovens
				0212	Recreational slide
				0213	Screen (drive-in theatre)
				0214	Drag strip
				0215	Athletic track
				0250	Arbitrary closure line
				0299	Processing line

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Manmade Features (cont'd.)	Feature identification (cont'd.)	Points (degenerate lines)	200	0300	Grave site
				0301	Historical marker
				0302	Mine tunnel entrance or cave
				0303	Mine shaft
				0304	Prospect
				0305	Tower
				0306	Burner/stack
				0307	Drilled well
				0308	Cliff dwelling
				0309	Light
				0310	Brick kiln
				0311	Drill hole
				0312	Watermill
				0313	Anchorage
				0314	Guzzler
				0315	Located object, landmark object
		Multiple element types	200	0400	Class 1 building
				0401	Class 2 building
				0402	Church
				0403	School
				0404	Municipal building
				0405	Courthouse
				0406	Post office
				0407	City or town hall
				0408	Hospital
				0409	Prison
				0410	Town, village, settlement, locality, unincorporated village
				0411	Amphitheater
				0420	Cemetery
				0421	Sewage disposal plant
				0422	Waterworks
				0423	Oil reservoir
				0424	Drilled well field
				0425	Tank
				0426	Offshore oil or gas platform
				0427	Mine dump
				0428	Open pit mine
				0429	Quarry

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Manmade Features (cont'd.)	Feature identification (cont'd.)	Multiple element types (cont'd.)	200	0430	Strip mine
				0431	Land fill
				0432	Pit, unconsolidated material
				0433	Radio or television facility
				0434	Storage bin
				0435	Levee
				0436	Spoil bank
				0445	Fairgrounds
				0446	Rodeo grounds
				0447	Corral
				0448	Boat ramp
				0449	Campground, campsite
				0450	Fort
				0451	Swimming pool
				0452	Archaeological site, ruin
				0453	Recreation area, public use area
				0454	Picnic area
				0455	Port of entry
				0456	Stadium
				0465	Pile, dolphin, stump, or snag
				0466	Breakwater, jetty, pier, dock, causeway, or wharf
				0467	Exposed wreck or wreckage
				0468	Sunken wreck
				0469	Drydock
	Descriptive	Multiple element types	200	0601	Underground
				0602	Under construction
				0603	Abandoned
				0604	Water
				0605	Oil
				0606	Gas
				0607	Chemical
				0608	Covered
				0609	Gravel
				0610	Sand
				0611	Clay
				0612	Borrow

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Manmade Features (cont'd.)	Descriptive (cont'd.)	Multiple element types (cont'd.)	200	0613	Radio
				0614	Lookout
				0615	Unincorporated
				0616	No population
				0617	Submerged
				0618	Ruin
			200	0000	Photorevised feature
	Parameter	Multiple element types	203	0---	Angle of clockwise rotation (nearest whole degree)
			202	----	Width in mils of feature to scale
			208	0000	Best estimate of position or classification
			209	00--	Coincident feature or symbol
U.S. Public Land Survey System (PLSS)	Feature identification	Nodes	300	0001	U.S. Public Land Survey System section corner
				0002	Point on section line (no corner)
				0003	Closing corner
				0004	Meander corner
				0005	Auxiliary meander corner
				0006	Special meander corner
				0007	Witness corner
				0008	Witness point
				0009	Angle point
				0010	Location monument (includes amended monument and mineral monument)
				0011	Reference mark
				0012	Quarter-section corner
				0013	Tract corner
				0014	Land grant corner
				0015	Arbitrary section corner
		Nodes (identification procedures	300	0040	Corner identified in field
				0041	Corner with horizontal coordinates
				0042	Corner with elevation value

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
U.S. Public Land Survey System (PLSS) (cont'd)	Parameters	Areas			Select one parameter code from each of the following A, B, C, and D lists and/or consult list E.
					A. Origin of Survey
			306	00--	Insert two-digit code from Appendix K.
					B. Township number(s)
			30-	----	Insert 2 for north of the baseline or 3 for south of the baseline in first space. In the second space, insert a 0 for full township, 2 for 1/4 township, 4 for 1/2 township, or 6 for 3/4 township. Insert township number in the last three spaces, right justified.
					C. Range number(s)
			30-	----	Insert 4 for east of the principal meridian or 5 for west of the principal meridian in the first space. In the second space, insert a 0 for a full range, 2 for 1/4 range, 4 for 1/2 range, 6 for 3/4 range, 8 for duplicate to the north or east of the original township, or 9 for triplicate to the north or east of the original township. Insert range number in last three spaces, right justified.

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
U.S. Public Land Survey System (PLSS) (cont'd)	Parameters	Areas (cont'd.)			D. Section number
			301	----	In the first space, insert 0 for numeric section identifier, 1 for numeric portion of alphanumeric identifier, or 2 for alphabetic part of alphanumeric identifier. In the last three spaces, insert section number or numeric representation of alphabetic character (01-26), right justified.
					E. Land grant identifier
			307	----	In the first space, insert the appropriate number:
				0	for numeric grant identifier
				1	for numeric portion of alphanumeric identifier
				2	for alphabetic portion of alphanumeric identifier
				3	for alphabetic identifier
				4	for identifier of named grant in Arizona
				5	for identifier of named grant in California
				6	for identifier of named grant in Colorado
				7	for identifier of named grant in New Mexico
					In the last three spaces after 0-3 above, insert the grant number or numeric representation of the alphabetic character (01-26), right-justified. In the last three spaces after 4-7 above, insert the three-digit code of the named grant as designated in Appendix L.

APPENDIX D.--DLG Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
U.S. Public Land Survey System (PLSS) (cont'd)	Parameters	Areas (cont'd)			F. Excluded areas
			300	0100	Indian lands
				0101	Homestead entries
				0102	Donation land claims
				0103	Land grants; civil colonies
				0104	Private extension of public land survey
				0105	Area of public and private survey overlap
				0106	Overlapping land grants
				0107	Military reservation
				0198	Water
				0199	Unsurveyed area
	Feature identification	Lines	300	0201	Approximate position (within 200 feet)
				0202	Protracted position
				0203	Arbitrary closure line
				0204	Base line
				0205	Claim line, grant line
		Points (degenerate lines)	300	0300	Location monument
				0301	Isolated found section corner
				0302	Witness corner (off surveyed line)
	Parameter	Multiple element types	308	0000	Best estimate of classification and/or position
			309	00--	Coincident feature or symbol

APPENDIX E.--Coordinate Conversion

This appendix illustrates the procedure for converting the internal file coordinates of the standard DLG format to the ground planimetric UTM reference coordinates. The formulas for this conversion, representing a simple offset, rotation, and scale, are as follows:

$$X = A1x + A2y + A3, \text{ and}$$
$$Y = A1y - A2x + A4,$$

where X and Y are the ground planimetric coordinate values and x and y are the internal file coordinates.

The parameters for these formulas (A1, A2, A3, and A4) are contained in Header Record B, as double-precision floating-point numbers.

This example converts four coordinate pairs from internal file coordinates to ground planimetric UTM zone 10 coordinate values. The parameters are as follows:

A1 = 0.60959440759
A2 = -0.0028817856942
A3 = 538248.79341
A4 = 4240374.4556

The internal file coordinates to be converted are as follows:

	x	y
1st pair	-8971	-11376
2nd pair	-8955	11375
3rd pair	8955	11376
4th pair	8971	-11376

The calculations to determine the ground planimetric coordinates for the first pair are as follows:

$$\begin{aligned} X &= (0.60959440759)\ (-8971) + (-0.0028817856942)\ (-11376) + (538248.79341) \\ &= 532812.91 \end{aligned}$$

$$\begin{aligned} Y &= (0.60959440759)\ (-11376) - (-0.0028817856942)\ (-8971) + (4240374.4556) \\ &= 4233413.86 \end{aligned}$$

The resulting X,Y coordinate values for the four pairs are as follows:

	X	Y
1st pair	532,812.91	4,233,413.86
2nd pair	532,757.10	4,247,282.79
3rd pair	543,674.93	4,247,335.01
4th pair	543,750.25	4,233,465.56

APPENDIX F.--Sample DLG Data File (Standard Distribution Format)

(Each 144-character record is shown as two consecutive 72-character lines.)

```
GLEN ELLEN                                     1968    24000

     3     1    10  -0.122033045000000D 09   0.380180450000000D 08   0.0
                     0.0                     0.0
   0.0                     0.0                     0.0
   0.0                     0.0                     0.0
   0.0                     0.0                     0.0
   0.0                       2   0.610000000000000D 00     0     4
  -0.122625000000000D 03   0.382500000000000D 02  -0.122625000000000D 03
   0.383750000000000D 02  -0.122500000000000D 03   0.383750000000000D 02
  -0.122500000000000D 03   0.382500000000000D 02

   0.609594407590000D 00  -0.288178569420000D-02   0.538248793410000D 06
   0.424037445560000D 07     4
SW -8971-11376NW -8955 11375NE  8955 11376SE  8971-11376

     1

BOUNDARIES (24&25)     795    16   795     7   530    20

N      1 -8971-11376     0     0

N      2 -8955 11375     0     0

N      3  8955 11376     0     0

N      4  8971-11376     0     0

N      5 -8966  3203     0     0

N      6  2101 11374     0     0

N      7  5832 11376     0     0

N      8  7513 11376     0     0

N      9  8956  7494     0     0

N     10  8961  2884     0     0

N     11  3469 10371     0     0

N     12  5530  9112     0     0

N     13 -3115-10127     0     0

N     14  7520 11175     1     0

    90     1
```

APPENDIX F.--Sample DLG Data File (Standard Distribution Format)--continued

(Each 144-character record is shown as two consecutive 72-character lines.)

```
N     15 -1450  4596     1     0
    90     1
N     16   895  4984     1     0
    90     1
A      1    22   253     1     0
     0     0
A      2 -4738  7527     2     0
    91     6    92    97

A      3  8325 10166     2     0
    91     6    92    97
A      4  4728 10834     3     0
    91     6    92    97    90   113
A      5  6463  8917     3     0
    91     6    92    97    90   113
A      6   161 -1378     3     0
    91     6    92    97    90   113
A      7 -3058-10280     4     0
    91     6    92    97    90   113    90   130
L      1     1     5     1     6     2     0     0
 -8971-11376 -8966  3203
L      2     5     2     1     2     2     0     0
 -8966  3203 -8955 11375
L      3     2     6     1     2     2     0     0
 -8955 11375  2101 11374
```

APPENDIX F.--Sample DLG Data File (Standard Distribution Format)--continued

(Each 144-character record is shown as two consecutive 72-character lines.)

```
L     4     6     7     1     2     4     0     0
  2101 11374  5832 11376
L     5     7     8     1     2     5     2     0
  5832 11376  7513 11376
L     6     8     3     1     3     2     0     0
  7513 11376  8955 11376
L     7     3     9     1     3     2     0     0
  8955 11376  8956  7494
L     8     9    10     1     5     2     0     0
  8956  7494  8961  2884
L     9    10     4     1     6     2     0     0
  8961  2884  8971-11376
L    10     4     1     1     6     2     0     0
  8971-11376 -8971-11376
L    11    13    13     7     6     6     0     0
 -3115-10127 -3189-10286 -2985-10432 -2890-10296 -2943-10236 -3115-10127
L    12     5    15     2     6     4     2     0
 -8966  3203 -5538   798 -1933  5820 -1450  4596
    99    30    90   203
L    13    15    16     2     6     2     2     0
 -1450  4596   895  4984
    99    30    90   203
L    14    14     8     5     3     2     2     0
  7520 11175  7513 11376
    99    30    90   203
```

APPENDIX F.--Sample DLG Data File (Standard Distribution Format)--continued

(Each 144-character record is shown as two consecutive 72-character lines.)

```
L     15    14     9     3     5     5     2     0

  7520 11175  7532 10014  7228  9681  7318  8896  8956  7494

    99    30    90   203

L     16    16    11     2     6   116     2     0

          895  4984   403  5222   275  5186   261  5244   247  5272   188  5344
          166  5364   146  5388   117  5441   107  5501   110  5561   104  5591
          106  5621   122  5681   144  5769   169  5829   199  5882   236  5931
          257  5952   313  5979   336  5999   350  6028   362  6087   362  6147
          352  6208   350  6238   355  6268   372  6295   415  6339   427  6367
          487  6471   496  6500   482  6682   491  6742   496  6803   510  6891
          512  6921   507  6955   507  6984   516  7015   530  7040   553  7062
          629  7111   656  7124   686  7132   741  7160   800  7179   858  7205
          921  7210   982  7223  1011  7236  1026  7261  1068  7309  1119  7386
         1181  7491  1228  7529  1254  7543  1285  7548  1316  7558  1339  7577

...etc....
```

APPENDIX G.--Sample DLG Data File (Optional Distribution Format)

(Each 80-character record is shown as a single line.)

```
USGS-NMD  DLG DATA - CHARACTER FORMAT - 09-29-82 VERSION
GLEN ELLEN                                     1968    24000

     3     1    10     2 0.61000000000D+00     4     0     4     1
  -0.122033045000000D+09   0.380180450000000D+08   0.0
   0.0                     0.0                     0.0
   0.0                     0.0                     0.0
   0.0                     0.0                     0.0
   0.0                     0.0                     0.0
 0.10000000000D+01 0.0               0.0               0.0
SW       38.250000 -122.625000         532812.91  4233413.86
NW       38.375000 -122.625000         532757.10  4247282.79
NE       38.375000 -122.500000         543674.93  4247335.01
SE       38.250000 -122.500000         543750.25  4233465.56
BOUNDARIES (24&25)     0    16    16 010     7     7 010   20     20   1
N    1   532812.91  4233413.86           2           0     0
     1   -10
N    2   532757.10  4247282.79           2           0     0
    -2     3
N    3   543674.93  4247335.01           2           0     0
    -6     7
N    4   543750.25  4233465.56           2           0     0
    -9    10
N    5   532773.94  4242301.15           3           0     0
    -1     2    12
N    6   539496.77  4247314.04           3           0     0
    -3     4    17
N    7   541771.16  4247326.01           3           0     0
    -4     5   -19
N    8   542795.89  4247330.85           3           0     0
    -5     6   -14
N    9   543686.72  4244968.57           3           0     0
    -7     8   -15
N   10   543703.06  4242158.35           3           0     0
    -8     9   -20
N   11   540333.59  4246706.56           3           0     0
   -16   -17    18
N   12   541593.59  4245945.02           3           0     0
   -18    19    20
N   13   536379.09  4234192.12           2           0     0
    11   -11
N   14   542800.74  4247208.34           2           1     0
    14    15
    90     1
N   15   537351.64  4243171.97           2           1     0
   -12    13
    90     1
N   16   538780.02  4243415.25           2           1     0
   -13    16
    90     1
```

APPENDIX G.--Sample DLG Data File (Optional Distribution Format)--continued

(Each 80-character record is shown as a single line.)

```
A    1   538261.48  4240528.75          10     0     1     0     0
   -10    -9    -8    -7    -6    -5    -4    -3    -2    -1
     0     0
A    2   535338.84  4244949.22           6     0     2     0     0
   -12     2     3    17   -16   -13
    91     6    92    97
A    3   543294.37  4246595.58           4     0     2     0     0
   -15    14     6     7
    91     6    92    97
A    4   541099.73  4246992.43           4     0     3     0     0
   -17     4   -19   -18
    91     6    92    97    90   113
A    5   542162.91  4245828.83           6     0     3     0     0
    19     5   -14    15     8   -20
    91     6    92    97    90   113
A    6   538350.91  4239534.90          10     0     3     0     1
    10     1    12    13    16    18    20     9     0    11
    91     6    92    97    90   113
A    7   536414.28  4234099.01           1     0     4     0     0
   -11
    91     6    92    97    90   113    90   130
L    1     1     5     1     6                 2     0     0
   532812.91  4233413.86   532773.94  4242301.15
L    2     5     2     1     2                 2     0     0
   532773.94  4242301.15   532757.10  4247282.79
L    3     2     6     1     2                 2     0     0
   532757.10  4247282.79   539496.77  4247314.04
L    4     6     7     1     4                 2     0     0
   539496.77  4247314.04   541771.16  4247326.01
L    5     7     8     1     5                 2     0     0
   541771.16  4247326.01   542795.89  4247330.85
L    6     8     3     1     3                 2     0     0
   542795.89  4247330.85   543674.93  4247335.01
L    7     3     9     1     3                 2     0     0
   543674.93  4247335.01   543686.72  4244968.57
L    8     9    10     1     5                 2     0     0
   543686.72  4244968.57   543703.06  4242158.35
L    9    10     4     1     6                 2     0     0
   543703.06  4242158.35   543750.25  4233465.56
L   10     4     1     1     6                 2     0     0
   543750.25  4233465.56   532812.91  4233413.86
L   11    13    13     7     6                 6     0     0
   536379.09  4234192.12   536334.44  4234094.98   536459.22  4234006.56
   536516.74  4234089.74   536484.26  4234126.17   536379.09  4234192.12
L   12     5    15     2     6                 4     2     0
   532773.94  4242301.15   534870.56  4240844.95   537053.68  4243916.72
   537351.64  4243171.97
    99    30    90   203
```

APPENDIX G.--Sample DLG Data File (Optional Distribution Format)--continued

(Each 80-character record is shown as a single line.)

```
L   13    15    16     2     6                 2     2     0
   537351.64  4243171.97   538780.02  4243415.25
    99    30    90   203
L   14    14     8     5     3                 2     2     0
   542800.74  4247208.34   542795.89  4247330.85
    99    30    90   203
L   15    14     9     3     5                 5     2     0
   542800.74  4247208.34   542811.40  4246500.64   542627.04  4246296.77
   542684.17  4245818.50   543686.72  4244968.57
    99    30    90   203

L   16    16    11     2     6               116     2     0
   538780.02  4243415.25   538479.41  4243558.92   538401.49  4243536.60
   538392.79  4243571.92   538384.17  4243588.95   538348.00  4243632.67
   538334.53  4243644.80   538322.27  4243659.37   538304.44  4243691.60
   538298.17  4243728.14   538299.82  4243764.73   538296.08  4243783.00
   538297.21  4243801.29   538306.79  4243837.91   538319.95  4243891.62
   538335.02  4243928.27   538353.15  4243960.66   538375.57  4243990.64
   538388.31  4244003.50   538422.37  4244020.12   538436.33  4244032.38
   538444.78  4244050.10   538451.93  4244086.10   538451.75  4244122.68
   538445.48  4244159.83   538444.17  4244178.11   538447.14  4244196.42
   538457.42  4244212.92   538483.51  4244239.87   538490.74  4244256.97
   538527.02  4244320.54   538532.42  4244338.25   538523.36  4244449.15
   538528.68  4244485.76   538531.55  4244522.96   538539.83  4244576.64
   538540.96  4244594.93   538537.81  4244615.65   538537.73  4244633.32
   538543.13  4244652.25   538551.59  4244667.53   538565.55  4244681.00
   538611.74  4244711.09   538628.16  4244719.10   538646.42  4244724.06
   538679.87  4244741.29   538715.78  4244753.04   538751.06  4244769.06
   538789.45  4244772.29   538826.60  4244780.39   538844.24  4244788.39
   538853.31  4244803.68   538878.78  4244833.06   538909.64  4244880.14
   538947.14  4244944.33   538975.68  4244967.63   538991.49  4244976.24
   539010.37  4244979.38   539029.24  4244985.56   539043.21  4244997.21
.... etc.....
```

APPENDIX H.--Pre-1983 Hydrographic Attribute Codes

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Rivers and Streams	Feature identification	Nodes	030	0001	River/stream, upper origin
				0002	River/stream, upper origin of stream at water body
				0003	River/stream, stream junction
				0004	River/stream, stream intersection with bank/shore or estuary
				0005	River/stream, sink (stream goes underground or channel is not evident)
				0006	River/stream, change in stream classification/status
				0007	River/stream, point on stream or centerline
				0008	River/stream, stream-canal intersection
				0009	River/stream, canal-canal intersection
				0010	River/stream, end of canal
				0011	River/stream, canal-shoreline intersection
				0012	River/stream, canal over canal
				0013	River/stream, canal over stream
				0020	River/stream, stream road intersection
				0021	River/stream, stream railroad intersection
				0022	River/stream, stream trail intersection
				0023	River/stream, stream transmission line intersection
				0024	River/stream, stream pipeline intersection
				0025	River/stream, aqueduct over stream
				0026	River/stream, aqueduct over aqueduct
				0027	River/stream, stream tunnel intersection
				0028	River/stream, stream dam intersection
				0029	River/stream, spillway
				0030	River/stream, flood gate or gate

APPENDIX H.--Pre-1983 Hydrographic Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Rivers and Streams (cont'd.)	Feature identification	Nodes (cont'd.)	030	0031	River/stream, tide gate
				0032	River/stream, falls
				0033	River/stream, end of rapids
				0034	River/stream, river mile mark
				0035	River/stream, tunnel portal
				0036	River/stream, end of siphon
				0037	River/stream, end of flume
				0038	River/stream, end of penstock
				0050	River/stream, point on bank/shore+
				0051	River/stream, shore/bank dam intersection
				0052	River/stream, gaging station
				0053	River/stream, pumping station
				0054	River/stream, small dam or weir
				0055	River/stream, water intake
		Areas	000	0000	Area outside graph
		Lines	030	0226	River/stream, penstock
				0227	River/stream, irrigation ditch
				0228	River/stream, irrigation canal
				0229	River/stream, abandoned canal
				0230	River/stream, canal on levee
				0250	River/stream, right bank, intermittent stream
				0251	River/stream, left bank, intermittent stream
				0252	River/stream, right bank, perennial stream
				0253	River/stream, left bank, perennial stream
				0254	River/stream, right bank, braided stream
				0255	River/stream, left bank, braided stream
				0256	River/stream, right bank, unsurveyed stream

APPENDIX H.--Pre-1983 Hydrographic Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Rivers and Streams (cont'd.)	Feature identification	Lines (cont'd.)	030	0257	River/stream, left bank, unsurveyed stream
				0258	River/stream, right bank, sand wash
				0259	River/stream, left bank, sand wash
				0260	River/stream, right bank, submerged stream
				0261	River/stream, left bank, submerged stream
				0270	River/stream, shore of island
				0271	River/stream, shore of backwater
				0272	River/stream, bank along levee
				0273	River/stream, apparent shoreline (outer limits of vegetation)
				0274	River/stream, shoreline along pier, wharf, or jetty
				0280	River/stream, rapids
				0293	River/stream, canal centerline extended into lake or pond
				0294	River/stream, stream centerline - indefinite location
				0295	River/stream, stream centerline extended into marsh or swamp
				0296	River/stream, stream centerline extended into river
				0297	River/stream, stream centerline extended into lake or pond
				0298	River/stream, stream centerline extended underground
				0299	River/stream, closing line (water-water)
		Points (Degenerate Lines)		0350	Single-point feature, river/stream, small island or exposed rock
				0352	Single-point feature, river/stream, spillway
				0353	Single-point feature, river/stream, flood gate or gate
				0354	Single-point feature, river/stream, tide gate

APPENDIX H.--Pre-1983 Hydrographic Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Rivers and Streams (cont'd.)	Feature identification	Points (Degenerate lines) (cont'd.)	030	0355	Single-point feature, river/stream, river mile mark
				0356	Single-point feature, river/stream, gaging station
				0357	Single-point feature, river/stream, pumping station
				0358	Single-point feature, river/stream, water intake
		Multiple element types	030	0000	Feature added by photorevision methods
	Parameter	Multiple element types	03N	----	Elevation of water surface (right justified) N=1 for feet, N=2 for meters, N=6 for feet below datum
			03N	----	Water depth (right justified) N=3 for feet, N=4 for meters
			035	----	River mile (right justified)
			038	0000	Best estimate of classification and/or position
			039	00--	Coincident feature or symbol (enter first two digits of major code for category of coincident feature in blanks, right justified).
Water Bodies	Feature identification	Nodes	040	0001	Water body, point on shoreline
				0002	Water body, shoreline road intersection
				0003	Water body, shoreline railroad intersection
				0004	Water body, shoreline transmission line intersection
				0005	Water body, shoreline pipeline intersection

APPENDIX H.--Pre-1983 Hydrographic Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Water Bodies (cont'd.)	Feature identification	Areas	000	0000	Area outside graph
			040	0100	Water body, perennial lake or pond
				0101	Water body, perennial salt lake or pond
				0102	Water body, intermittent lake or pond
				0103	Water body, intermittent salt lake or pond
				0104	Water body, dry lake or pond
				0105	Water body, alkali flat
				0106	Water body, reservoir
				0107	Water body, intermittent reservoir
				0110	Water body, glacier or snow field
				0111	Water body, crevasse area
				0120	Water body, salt evaporator
				0122	Water body, fish hatchery
				0123	Water body, area subject to controlled flooding for agriculture
				0124	Water body, industrial water impoundment
				0125	Water body, area to be submerged
				0126	Water body, fish farm or crawfish farm
				0127	Water body, sewage disposal pond
				0128	Water body, large water intake
				0129	Water body, tailings pond
				0130	Water body, wooded lake
				0150	Water body, island
				0199	Water body, area not in water body
				0200	Water body, shoreline
				0201	Water body, indefinite shoreline
				0202	Water body, shoreline along wall
				0203	Water body, shoreline along wharf, pier, or jetty
				0204	Water body, shoreline along dam
				0205	Water body, shoreline along causeway
				0210	Water body, edge of glacier or snowfield
				0211	Water body, edge of crevasse area
				0299	Water body, closure line (water-water)

APPENDIX H.--Pre-1983 Hydrographic Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Water Bodies (cont'd.)	Feature identification	Lines (cont'd.)	040	0300	Single-point feature, water body, spring
				0301	Single-point feature, water body, nonflowing well
				0302	Single-point feature, water body, flowing well
				0350	Single-point feature, water body, small island or exposed rock
				0351	Single-point feature, water body, small perennial pond
				0352	Single-point feature, water body, small intermittent pond
				0353	Single-point feature, water body, riser or glory hole
				0354	Single-point feature, water body, brine or salt well
				0355	Single-point feature, water body, sulphur well
				0356	Single-point feature, water body, geyser
		Multiple element types	040	0000	Feature added by photorevision method
	Parameter	Multiple element types	04N	----	Water surface elevation (right justified) N=1 for feet, N=2 for meters, N=6 for feet below datum
			04N	----	Water depth (right justified) N=3 for feet, N=4 for meters
			048	0000	Best estimate of classification and/or position
			049	00--	Coincident feature or symbol (enter first two digits of major code for category of coincident feature in blanks, right justified)

APPENDIX I.--Pre-1985 Transportation Attribute Codes

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Transportation, Roads	Feature identification	Nodes	100	0001	Road intersection
				0002	Road intersection (grade separation, no interchange)
				0003	Road intersection (grade separation with interchange)
				0004	Road intersection (grade separation, partial interchange)
				0005	Road-railroad intersection
				0006	Road-railroad intersection (grade separation)
				0007	Road-stream intersection (fixed bridge/culvert)
				0008	Road-stream intersection (movable bridge)
				0009	Road-trail intersection
				0010	Trail-trail intersection
				0011	Bridge abutment
				0012	Tunnel portal
				0013	Road-transmission line intersection
				0014	Road-pipeline intersection
				0015	Ferry landing
				0016	Change in road classification/status
				0017	Structure over road
				0018	Ford
				0019	Low water bridge
				0020	Toll gate
				0021	Traffic circle
				0022	Cul-de-sac
				0023	Gate
				0024	Road-canal intersection (where canal is a transportation feature)
				0030	Foot or bicycle bridge over road
				0050	Point on road
				0051	End of road/trail
				0060	Port of entry
				0061	U.S. Customs

APPENDIX I.--Pre-1985 Transportation Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Transportation, Roads (cont’d)	Feature identification	Areas	000	0000	Area outside graph
		Lines	100	N201	Primary route, hard surface (undivided)
				N202	Primary route, hard surface (divided, 25’ or less)
				N203	Primary route, hard surface (divided, 25’ or more)
				N204	Primary route, hard surface (one-way traffic)
				N205	Secondary route, hard surface (one-way traffic)
				N206	Secondary route, hard surface
				N207	Improved light duty
				N208	Unimproved dirt
				N209	Trail
				N210	4-wheel-drive vehicle trail
				N211	Urban streets
				N212	Foot trail
				N213	Bridle trail
				N214	Pack trail
				N215	Historical trail
				N216	Bicycle trail
				N217	Primary route, hard surface (interchange road)
				N218	Secondary route, hard surface (interchange road)
				N219	Improved light-duty interchange road
				N220	Secondary route, divided
				N222	Road or street, class 3, divided by centerline
				N223	Road or street, class 3, divided, lanes separated
				N240	Ferry crossing
				N241	Road through parking area
				N250	Perimeter of parking area
				N293	Road or trail subject to inundation
				N294	Road or trail on dam

APPENDIX I.--Pre-1985 Transportation Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Transportation, Roads (cont'd.)	Feature identification (cont'd.)	Lines (cont'd.)	100	N295	Road or trail on bridge
				N296	Road or trail on levee
				N297	Road or trail tunnel under ground
				N298	Road or trail tunnel under water
				N299	Road or trail under construction
					N=0 for unrestricted access, N=1 for limited access, N=2 for toll road, N=3 for privately operated or controlled public access, N=4 for proposed road, N=5 for abandoned road
		Points (degenerate lines)	100	0301	Roadside or wayside park
				0302	Rest area
				0303	Overlook
				0304	Weigh station
				0305	Service facility
		Multiple element types	100	0000	Feature added by photorevision methods
	Parameter	Multiple element types	101	00--	Number of lanes, right justified
			102	0---	Interstate route number, right justified
			103	0---	U.S. route number, right justified
			104	----	State route number, right justified
			105	----	Reservation, park, or military route number, right justified
			106	----	County route number, right justified
			108	0000	Best estimate of classification and/or position
			109	0---	Coincident feature or symbol (enter first two digits of major code for category of coincident feature in blanks, right justified)

APPENDIX I.--Pre-1985 Transportation Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Transportation, Railroads	Feature identification	Nodes	110	0001	Railroad intersection
				0002	Railroad intersection (grade separation)
				0003	Siding junction
				0004	Station
				0005	Railroad-road intersection
				0006	Railroad-road intersection (grade separation)
				0007	Railroad-stream intersection (fixed bridge/culvert)
				0008	Railroad-stream intersection (movable bridge)
				0009	Railroad-trail intersection
				0010	Bridge abutment
				0011	Tunnel portal
				0012	Railroad-transmission line intersection
				0013	Railroad-pipeline intersection
				0014	Ferry landing
				0015	Change in railroad classification/ status
				0016	Structure over railroad
				0017	Turntable
				0018	Turntable and roundhouse
				0019	Point within yard
				0049	Crossover
				0050	Point on railroad
				0051	End of railroad
		Areas	000	0000	Area outside graph
		Lines	110	N201	Single track standard gage
				N202	Double track, standard gage
				N203	3-track, standard gage
				N204	4-track, standard gage
				N205	5 or more tracks, standard gage
				N206	Siding, standard gage
				N211	Single track, narrow gage

APPENDIX I.--Pre-1985 Transportation Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Transportation, Railroads (cont'd.)	Feature identification (cont'd.)	Lines (cont'd.)	110	N212	Double track, narrow gage
				N213	3-track, narrow gage
				N214	4-track, narrow gage
				N215	5 or more tracks, narrow gage
				N216	Siding, narrow gage
				N220	Carline or surface rapid transit
				N221	Elevated rapid transit
				N230	Industrial or mine railroad
				N240	Ferry crossing
				N241	Railroad through yard
				N250	Perimeter of yard
				N294	Railroad on pier
				N295	Railroad on bridge
				N296	Railroad on levee
				N297	Railroad tunnel under ground
				N298	Railroad tunnel underwater
				N299	Railroad in snowshed
					N=0 for normal use, N=1 for under construction, N=2 for abandoned, N=3 for dismantled
		Points (degenerate lines)	NONE		
		Multiple element types	110	0000	Feature added by photorevision methods
	Parameter	Multiple element types	118	0000	Best estimate of classification and/or position
			119	00--	Coincident feature or symbol (enter first two digits of major code for category of coincident feature, right justified).
Pipelines, Transmission Lines	Feature identification	Nodes	130	0001	Transmission line intersection
				0002	Pipeline intersection
				0003	Transmission line - pipeline intersection

APPENDIX I.--Pre-1985 Transportation Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Pipelines, Transmission Lines	Feature identification (cont'd.)	Nodes (cont'd.)	130	0004	Transmission line - road intersection
				0005	Pipeline - road intersection
				0006	Transmission line - railroad intersection
				0007	Pipeline - stream intersection
				0008	Transmission line - stream intersection
				0009	Pipeline - stream intersection
				0010	Transmission line - telephone/ telegraph line intersection
				0011	Pipeline - bank/shore intersection
				0012	Transmission line - telephone/ telegraph line intersection
				0013	Pipeline - telephone/telegraph line intersection
				0014	Pumping station
				0015	Substation
				0016	Steel tower
				0020	Change in classification/status
				0030	Angle point on transmission line
				0031	Angle point on pipeline
				0032	Point on transmission line
				0033	Point on pipeline
				0034	End of transmission line
				0035	End of pipeline
				0036	End of transmission line at power station or substation
				0037	End of pipeline at refinery/oil-gas field
		Areas	000	0000	Area outside graph
		Lines	130	0201	Single- or double-pole powerline
				0202	Steel tower powerline
				0203	Single- or double-pole powerline extended over water
				0204	Steel tower powerline extended over water

APPENDIX I.--Pre-1985 Transportation Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Pipelines, Transmission Lines (cont'd.)	Feature identification (cont'd.)	Lines (cont'd.)	130	0205	Single- or double-pole powerline extended into urban area
				0206	Steel tower powerline extended into urban area
				0211	Pipeline (under ground)
				0212	Pipeline (above ground)
				0213	Pipeline (under water)
				0214	Pipeline (above water)
				0215	Pipeline, through siphon
				0216	Pipeline, through flume
				0217	Pipeline extended into urban area
				0221	Telephone or telegraph line
		Points	NONE		
		Multiple element types	130	0000	Feature added by photorevision methods
	Parameter	Multiple element types	138	0000	Best estimate of classification and/or position
			139	00--	Coincident feature or symbol (enter first two digits of major code for category of coincident feature, right justified).
			139	01--	Assumed position next to parallel feature or symbol (enter first two digits of major code for category of parallel feature, right justified).

APPENDIX J.--Pre-1985 Other Significant Cultural Feature Attribute Codes

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Other Significant Cultural Features	Feature identification	Node	140	0001	End point of linear manmade feature
				0002	Point on linear manmade feature
		Area	140	0100	Large class 1 building
				0101	Large class 2 building
				0102	Large church
				0103	Church complex (convent, retreat, etc.)
				0104	Large school
				0105	School campus (univ., college, etc.)
				0106	Large municipal building
				0107	Large court house
				0108	Large post office
				0109	Large city or town hall
				0110	Large hospital
				0111	Hospital complex (sanatorium, VA hospital, etc.)
				0112	Orphanage
				0126	Large cemetery
				0127	Large power plant
				0128	Large power substation
				0129	Large sewage disposal plant
				0130	Large waterworks
				0131	Trailer park
				0132	Stadium
				0133	Athletic fields
				0134	Shopping center
				0135	Zoo
				0136	Golf course
				0138	Fairground
				0139	Rodeo grounds
				0140	Corral
				0141	Race track
				0142	Drag strip
				0143	Ski area
				0144	Drive-in theater
				0145	Marina

APPENDIX J.--Pre-1985 Other Significant Cultural Feature Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Other Significant Cultural Features (cont'd.)	Feature identification	Node (cont'd)	140	0146	Large boat ramp
				0147	Large dam
				0148	Large campground, recreation area, public use area, or access area (other than National or State)
				0149	Covered water reservoir
				0150	Large fort
				0151	Airport or landing strip
				0152	Abandoned airport
				0153	Prison compound
				0164	Urban tint
				0165	Unincorporated village (populated)
				0166	Locality (no population)
				0167	Industrial park
				0168	Large spoil bank
				0169	Industrial materials storage area
				0170	Oil or gas field
				0171	Large water tank
				0172	Large tank
				0173	Refinery or gas plant
				0174	Chemical plant
				0175	Nuclear plant
				0176	Gas storage area (underground)
				0177	Kilns
				0178	Charcoal ovens
				0179	Mine dump (tailings)
				0180	Open surface mine or quarry
				0182	Land fills
				0183	Disturbed areas
				0184	Sludge or slurry disposal
				0185	Oil sump or sludge pit
				0186	Large ruins
				0187	Tank farm
				0188	Feedlot
				0189	Experimental farm
				0190	Proving grounds
				0191	Firing range
				0192	Missile launch complex

APPENDIX J.--Pre-1985 Other Significant Cultural Feature Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Other Significant Cultural Features (cont'd.)	Feature identification	Node (cont'd)	140	0193	Piles, dolphins, stumps, or snags
				0194	Exposed wreckage
				0195	Cable area
				0196	Breakwater, pier, wharf
				0197	Covered pier or wharf
				0199	Area outside manmade feature
		Lines	140	0240	Ski lift
				0241	Tram way
				0242	Snow shed
				0243	Conveyor
				0279	Coke oven
				0282	Linear strip mine
				0291	Boardwalk
				0292	Wall
				0293	Causeway
				0294	Levee
				0295	Sea wall
				0296	Breakwater, pier, jetty, or wharf
		Points (degenerate lines)	140	0300	Class 1 building
				0301	Class 2 building
				0302	Church
				0303	School
				0304	Municipal building
				0305	Court house
				0306	Post office
				0307	City or town hall
				0308	Power plant
				0309	Fort
				0310	Power substation
				0311	Sewage disposal plant
				0312	Pumping station
				0313	Hospital
				0314	Waterworks
				0315	Swimming pool

APPENDIX J.--Pre-1985 Other Significant Cultural Feature Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Other Significant Cultural Features (cont'd.)	Feature identification	Points (degenerate lines) (cont'd)	140	0320	Radio facility
				0321	Radio tower
				0322	Lookout tower
				0323	Windmill
				0324	Heliport
				0330	Campsite
				0331	Picnic site
				0332	Grave site
				0333	Historical site or marker
				0334	Archeological site
				0335	Cliff dwelling
				0336	Cavern
				0337	Boat ramp
				0338	Dock/wharf
				0339	Fairground
				0340	Rodeo grounds
				0341	Corral
				0350	Quarry or pit (includes gravel, clay, sand, rock, etc.)
				0351	Mine tunnel entrance or cave
				0352	Mine shaft
				0353	Prospect
				0354	Burner/stack
				0355	Storage bin
				0360	Ruins
				0361	Pile, dolphin, stump or snag
				0362	Exposed wreck
				0380	Lock
				0381	Spillway
				0382	Drydock
				0384	Oil or gas well, drill hole, or drilling platform
				0385	Small tank
				0386	Small water tank

APPENDIX J.--Pre-1985 Other Significant Cultural Feature Attribute Codes--continued

DATA CATEGORY	TYPE OF CODE	APPLICATION	MAJOR CODE	MINOR CODE	DESCRIPTION
Other Significant Cultural Features (cont'd.)	Parameter	Multiple element types	141	00--	Under construction (enter year of map)
			142	00--	Abandoned or not in use (enter year of map)
			149	00--	Coincident feature or symbol (enter major code for category of coincident feature, right justified)

APPENDIX K.--Origins of the U.S. Rectangular Surveys

Code	Designation	Type	States	Date
01	First Principal	PM	OH,IN	1819
02	Second Principal	PM	IL,IN	1805
03	Third Principal	PM	IL	1805
04	Fourth Principal	PM	IL	1815
05	Fifth Principal	PM	AR,IA,MN,MO,ND,SD	1815
06	Sixth Principal	PM	CO,KS,NE,SD,WY	1855
07	Black Hills	PM	SD	1878
08	Boise	PM	ID	1867
09	Chickasaw	PM	MS	1833
10	Choctaw	PM	MS	1821
11	Cimmaron	PM	OK	1881
12	Copper River	PM	AK	1905
13	Fairbanks	PM	AK	1910
14	Gila and Salt River	PM	AZ	1865
15	Humboldt	PM	CA	1853
16	Huntsville	PM	AL,MS	1807
17	Indian	PM	OK	1870
18	Louisiana	PM	LA	1807
19	Michigan	PM	MI,OH	1815
20	Principal	PM	MT	1867
21	Mount Diablo	PM	CA,NV	1851
22	Navajo	PM	AZ	1869
23	New Mexico Principal	PM	CO,NM	1855
24	St. Helena	PM	LA	1819
25	St. Stephens	PM	AL,MS	1805
26	Salt Lake	PM	UT	1855
27	San Bernard	PM	CA	1852
28	Seward	PM	AK	1911
29	Tallahasee	PM	FL,AL	1824
30	Uintah	PM	UT	1875
31	Ute	PM	CO	1880
32	Washington	PM	MS	1803
33	Willamette	PM	OR,WA	1851
34	Wind River	PM	WY	1875
35	Ohio River Survey	SN	OH	1785
36	Between the Miamis	SN	OH	1802
37	Muskingum River	SN	OH	1800
38	Ohio River Base	SN	IN	1799
39	First Scioto River	SN	OH	1799
40	Second Scioto River	SN	OH	1799
41	Third Scioto River	SN	OH	1799
42	Ellicott's Line*			
43	Twelve-Mile Square	SN	OH	1805
44	Kateel River	PM	AK	1956
45	Umiat	PM	AK	1956
46	Fourth Principal	PM	MN,WI	1831
47	West of the Great Miami	SN	OH	1798
48	U.S. Military Survey	SN	OH	1797
99	Not Public Land Survey*			

---

* Not digitized; included only for compatibility with BLM table.

APPENDIX L.--Named Land Grant Codes

ARIZONA

001 ARIBACA
002 LUiS MARIA BACA FLOAT #3
003 LUIS MARIA BACA FLOAT #5
004 LOS NOGALES DE ELLAS
005 MARIA SANTISIMA DEL CARMEN
006 RANCHO DE MARTINEZ
007 SABINO OTERO ET AL
008 SAN BERNARDINO
009 SAN IGNACIO DE LA CANOA
010 SAN IGNACIO DEL BABOCOMARI
011 SAN JOSE DE SONOITA
012 SAN JUAN DE LAS BOQUILLAS Y NOGALES
013 SAN RAFAEL DE LA ZANJA
014 SAN RAFAEL DEL VALLE
015 TUMACACORI AND CALABAZAS

CALIFORNIA

001 SAN BUENA VENTURA
002 EL PRIMER CANON
003 LA BARRANCA COLORADA
004 LAS FLORES
005 SAUCOS
006 RIO DE LOS MOLINOS
007 BOSQUEJO
008 CAPAY
009 ARROYO CHICO
010 RANCHO DE FARWELL
011 JACINTO
012 LLANO SECO
013 AGUAS FRIAS
014 ESQUON
015 FERNANDEZ
016 LARKINS CHILDRENS RANCHO
017 COLUSA
018 BOGA
019 HONCUT
020 NEW HELVETIA
021 JOHNSON RANCHO
022 JIMENO
023 YOKAYA
024 SANEL
025 GERMAN
026 MUNIZ
027 BODEGA
028 ESTERO AMERICANO
029 BLUCHER
030 LAGUNA DE SAN ANTONIO
031 SOULAJULE LANDS
032 NICASIO LANDS
033 PUNTA DE LOS REYES-RANDALL
034 PUNTA DE LOS REYES--SOBRANTE
035 LAS BAULINES
036 SAUCELITO
037 TOMALES Y BAULINES--PHELPS
038 TOMALES Y BAULINES--GARCIA
039 SAN GERONIMO (MARIN)
040 CANADA DE HERRERA
041 PUNTA DE QUENTIN
042 CORTE DE MADERA DEL PRESIDIO
043 SAN RAFAEL
044 SAN PEDRO SANTA MAGARITA Y LAS GALLINAS
045 SAN JOSE--PACHECO
046 NOVATO
047 CORTE MADERA DE NOVATO
048 OLOMPALI
049 PETALUMA
050 ROBLAR DE LA MISERIA
051 CANADA DE POGOLIMI
052 CANADA DE JONIVE
053 MOLINOS
054 SOTOYOME
055 TZABACO
056 RINCON DE MUSALACON
057 CASLAMAYOMI
058 GUENOC
059 COLLAYOMI
060 MALLACOMES OR MORISTUL
061 MALLACOMES Y PLAN D AGUA CALIENTE
062 SAN MIGUEL--WEST
063 CABEZA DE SANTA ROSA
064 LLANO DE SANTA ROSA
065 COTATE

CALIFORNIA (CONT.)

066 LOS GUILICOS
067 AGUA CALIENTE (SONOMA)
068 PUEBLO LANDS OF SONOMA
069 LAC
070 S F SOLAND IN SONOMA MISSION
071 SONOMA CITY LOT IN
072 HUICHICA
073 RINCON DE LOS CARNEROS
074 ENTRE NAPA
075 TULUCAY
076 NAPA
077 YAJOME
078 CAYMUS
079 CARNE HUMANA
080 LA JOTA
081 LOCOALLOMI
082 CATACULA
083 LAS PUTAS
084 CANADA DE CAPAY
085 GUESISOSI
086 RIO JESUS MARIA
087 RIO DE LOS PUTOS
088 LOS PUTOS
089 CHIMILES
090 TOLENAS
091 SUISUN
092 LOS ULPINOS
093 SANJON DE LOS MOQUELUMNES
094 COSUMNES
095 OMOCHUMNES
096 DEL PASO
097 SAN JUAN
098 RIO DE LOS AMERICANOS
099 ARROYO SECO
100 CAMPO DE LOS FRANCESES
101 STANISLAUS RIVER
102 RANCHERIA DEL RIO ESTANISLAO
103 YOSEMITE & BIG TREE GRANTS
104 LAS MARIPOSAS
105 ORESTIMBA
106 RANCHO DEL PUERTO
107 EL PESCADERO--GRIMES
108 EL PESCADERO--PICO AND NAGLEE
109 CANADA DE LOS VAQUEROS
110 LOS MEGANOS
111 LOS MEDANOS
112 MONTE DEL DIABLO
113 LAS JUNTAS
114 CANADA DEL HAMBRE Y LOS BOLSAS
115 ARROYO DE LAS NUECES Y BOLBONES
116 SAN RAMON--CARPENTIER
117 SAN RAMON--NORRIS
118 SAN RAMON--AMADOR
119 SANTA RITA
120 LAS POSITAS
121 VALLE DE SAN JOSE--SUNOL & BERNAL
122 SAN LORENZO--CASTRO
123 LAGUNA DE LOS PALOS COLORADOS
124 ACALANES
125 LA BOCA DE LA CANADA DEL PINOLE
126 PINOLE
127 SAN PABLO
128 SAN ANTONIO--V & D PERALTA
129 SAN ANTONIO--A M PERALTA
130 SAN ANTONIO--Y PERALTA
131 SAN LEANDRO
132 SAN LORENZO--SOTO
133 ARROYO DE LA ALEMEDA
134 POTRERO DE LOS CERRITOS
135 MISSION SAN JOSE
136 AGUA CALIENTE (ALAMEDA & SANTA CLARA)
137 TULARCITOS--HIGUERA
138 MILPITAS--ALVISO
139 RINCON DE LOS ESTEROS-WHITE
140 RINCON DE LOS ESTEROS-BERREYESA
141 RINCON DE LOS ESTEROS-ALVISO
142 EMBARCADERO DE SANTA CLARA
143 ULISTAC
144 PASTORIA DE LAS BORREGAS
145 POSOLMI
146 RINCON DE SAN FRANCISQUITO
147 RINCONADA DEL ARROYO DE SAN FRANCISQUITO
148 PULGAS
149 SAN MATEO
150 BURI BURI
151 CANADA DE GUADALUPE VISITACION Y RODEO VIEJO

CALIFORNIA (CONT.)

152 CANADA DE GUADALUPE Y RODEO VIEJO
153 RINCON DE LAS SALINAS Y POTRERO VIEJO
154 SAN MIGUEL--NOE
155 PUEBLO LANDS OF SAN FRANCISCO
156 MISSION DOLORES
157 MISSION DOLORES 50 VARA LOT IN DE HARO
158 MISSION DOLORES--BERNAL
159 OJO DE AGUA DE FIGUEROA S F
160 MISSION DOLORES SUERTE IN
161 MISSION DOLORES
162 SAN FRANCISCO
163 LAGUNA DE LA MERCED
164 SAN PEDRO--SANCHEZ
165 CORRAL DE TIERRA--PALOMARES
166 CORRAL DE TIERRA--VASQUEZ
167 FELIZ
168 CANADA DE RAYMUNDO
169 MIRAMONTES
170 CANADA DE VERDE Y ARROYO DE LA PURISIMA
171 SAN GREGORIO--RODRIGUEZ
172 SAN GREGORIO--CASTRO
173 EL CORTE DE MADERA
174 SAN FRANCISQUITO--RODRIGUEZ
175 LA PURISIMA CONCEPCION
176 SAN ANTONIO--MESA
177 SANTA CLARA TR NR--ENRIGHT
178 EL POTRERO DE SANTA CLARA
179 PUEBLO LANDS OF SAN JOSE
180 PALA
181 CANADA DE PALA
182 LOS HUECOS
183 YERBA BUENA
184 SANTA TERESA
185 SAN JUAN BAUTISTA
186 LOS COCHES (SANTA CLARA)
187 QUITO
188 SANTA CLARA MISSION TR
189 SANTA CLARA COUNTY--BENNETT
190 SAN ANTONIO OR PESCADERO
191 BUTANO
192 RINCONADA DE LOS GATOS
193 CANADA DE LOS CAPITANCILLOS
194 LOS CAPITANCILLOS
195 SAN VICENTE--BERREYESA
196 LA LAGUNA SECA
197 CANADA DE SAN FELIPE Y LAS ANIMAS
198 SANJON DE SANTA RITA
199 OJO DE AGUA DE LA COCHE
200 LAS UVAS
201 SHOQUEL AUGMENTATION
202 SAN AUGUSTIN
203 ZAYANTA
204 SAN VICENTE--ESCARRILLA
205 PUNTA DEL ANO NUEVO
206 AGUA PUERCA Y LAS TRANCAS
207 REFUGIO
208 CANADA DEL RINCON EN EL RIO SAN LORENZO
209 LA CARBONERA
210 SANTA CRUZ MISSION
211 TRES OJOS DE AGUA
212 MESA DE OJO DE AGUA
213 POTRERO Y RINCON DE SAN PADRO DE REGLADO
214 ARROYO DEL RODEO
215 SHOQUEL
216 APTOS
217 LAGUNA DE LAS CALABASAS
218 LOS CORRALITOS
219 SAN ANDRES
220 BOLSA DEL PAJARO
221 BOLSA DE SAN CAYETANO
222 VEGA DEL RIO DEL PAJARO
223 SALSIPUEDES
224 LAS ANIMAS
225 SOLIS
226 SAN FRANCISCO DE LAS LLAGAS
227 LA POLKA
228 SAN YSIDRO--GILROY
229 SAN YSIDRO--ORTEGA
230 LLANO DEL TEQUISQUITA
231 BOLSA DE SAN FELIPE
232 SAN JOAQUIN (SAN BENITO)
233 AUSAYMAS Y SAN FELIPE
234 SAN LUIS GONZAGA
235 PANOCHE DE SAN JUAN Y LOS CARRISALITOS

APPENDIX L.--Named Land Grant Codes--continued

CALIFORNIA (CONT.)

236 REAL DE LAS AGUILAS
237 SANTA ANA Y QUIEN SABE
238 SAN JUSTO
239 LOMERIAS MUERTAS
240 MISSION SAN JUAN BAUTISTA
241 JURISTA
242 LAS AROMITAS Y AGUA CALIENTE
243 CANADA DE LA CARPENTERIA
244 LOS CARNEROS--LITTLEJOHN
245 BOLSA NUEVA Y MORO COJO
246 LOS CARNEROS--MCDOUGAL
247 SAN JUAN BAUTISTA TR NR
248 SAN JUAN BAUTISTA--BREEN
249 LOS VERGELES
250 CIENEGA DEL GABILAN
251 LA NATIVIDAD
252 BOLSA DE LAS ESCORPINAS
253 LOS GATOS OR SANTA RITA
254 BOLSA DEL POTRERO Y MORO COJO
255 RINCON DE LAS SALINAS
256 MONTEREY CITY
257 LAS SALINAS
258 MONTEREY COUNTY--CASTRO
259 EL TUCHO
260 TWO SUERTES
261 RINCON DE SANJON
262 MONTEREY COUNTY--COCKS
263 NACIONAL
264 SAUSAL
265 EL ALISAL--BERNAL
266 LLANO DE BUENA VISTA
267 EL ALISAL--HARTNELL
268 CIENEGA DE LOS PAICINES
269 ENCINAL Y BUENA ESPERANZA
270 CHUALAR
271 ZANJONES
272 RINCON DE LA PUENTE DEL MONTE
273 GUADALUPE Y LLANITOS DE LOS CORREOS
274 BUENA VISTA
275 EL TORO
276 LAGUNA SECA
277 SAUCITO
278 NOCHE BUENA
279 PUNTA DE PINOS
280 EL PESCADERO--JACK
281 MISSION CARMELOCHORRO
282 AGUAJIT
283 CANADA DE LA SEGUNDA
284 JAMES MEADOWS TRACT
285 LOS LAURELLES--RANSOM
286 EL POTRERO DE SAN CARLOS
287 SAN FRANCISQUITO
288 EL SUR
289 LOS LAURELLES--BERONDA
290 CORRAL DE TIERRA--MCCOBB
291 LOS TULARCITOS--GOMEZ
292 PARAJE DE SANCHEZ
293 SAN VICENTE--MUNRASS
294 EX-MISSION SOLEDAD
295 MISSION SOLEDAD
296 LOS COCHES (MONTEREY)
297 ARROYO SECO--TORRE
298 POSA DE LOS OSITOS
299 SAN LORENZO--SOBERANES
300 SAN LORENZO--SANCHEZ
301 LAGUNA DE TACHE
302 SAN LORENZO--RANDALL
303 SAN BERNABE
304 SAN BENITO
305 SAN LUCAS
306 SAN BERNARDO--SOBERANES
307 MILPITAS
308 MISSION SAN ANTONIO
309 SAN MIGUELITO (MONTEREY)
310 EL PIOJO
311 LOS OJITOS
312 PLEYTO
313 MISSION SAN MIGUEL
314 CHOLAME
315 HUERHUERO
316 SANTA MARGARITA
317 ATASCADERO
318 ASUNCION
319 SANTA YSABEL (SAN LUIS OBISPO)
320 PASO DE ROBLES
321 PIEDRA BLANCA
322 SAN SIMEON
323 SANTA ROSA--ESTRADA
324 SAN GERONIMO (SAN LUIS OBISPO)
325 MORO Y CAYUCOS
326 SAN BERNARDO--CANE

APPENDIX L.--Named Land Grant Codes--continued

CALIFORNIA (CONT.)

327 SAN LUISITO
328 EL CHORRO
329 POTRERO DE SAN LUIS OBISPO
330 HUERTA DE ROMUALDO
331 CANADA DE LOS OSOS Y PECHO Y ISLAY
332 LAGUNA
333 SAN LUIS OBISPO MISSION
334 RANCHITA DE SANTA FE
335 SAN MIGUELITO (SAN LUIS OBISPO)
336 PISMO
337 CORRAL DE PIEDRA
338 SANTA MANUELA
339 ARROYO GRANDE
340 HUASNA
341 CUYAMA--M A DE LA G Y LATAILLADE
342 CUYAMA--CESARIO LATAILLADE
343 SAN EMIDIO
344 EL TEJON
345 CASTAC
346 LOS ALAMOS Y AGUA CALIENTE
347 LA LIEBRE
348 SISQUOC
349 TEPUSQUET
350 SUEY
351 NIPOMO
352 BOLSA DE CHAMISAL
353 GUADALUPE
354 PUNTA DE LA LAGUNA
355 CASMALIA
356 JESUS MARIA
357 TODOS SANTOS Y SAN ANTONIO
358 LOS ALAMOS
359 TINAQUAIC
360 LA LAGUNA--GUTIERREZ
361 LA ZACA
362 CORRAL DE QUATI
363 CANADA DE LOS PINOS OR COLLEGE RANCHO
364 SAN MARCOS
365 TEQUEPIS
366 LOMAS DE LA PURIFICACION
367 NOJOQUI
368 MISSION OF SANTA YNEZ
369 SAN CARLOS DE JONATA
370 SANTA ROSA--COTA
371 SANTA RITA--MALO
372 MISSION LA PURISMA (SANTA BARBARA)
373 MISSION LA PURISMA
374 LOMPOC
375 PUNTA DE LA CONCEPCION
376 LA MISSION VIEJA DE LA PURISMA
377 CANADA DE SALSIPUEDES
378 SAN JULIAN
379 NUESTRA SENORA DEL REFUGIO
380 CANADA DEL CORRAL
381 LOS DOS PUEBLOS
382 LA GOLETA
383 LAS CIENEGAS
384 MISSION SANTA BARBARA
385 LAS POSITAS Y LA CALERA
386 PUEBLO LANDS OF SANTA BARBARA
387 EL RINCON--ARELLANES
388 SANTA ANA
389 OJAI
390 CANADA LARGA O VERDE
391 CANADA DE SAN MIGUELITO
392 MISSION SAN BUENAVENTURA
393 LOT MISSION SAN BUENAVENTURA
394 SAN MIGUEL-OLIVAS & LORENZANA
395 SANTA PAULA Y SATICOY
396 EX-MISSION SAN BUENAVENTURA LANDS OF
397 SESPE
398 TEMASCAL
399 SAN FRANCISCO
400 SIMI
401 LAS POSAS
402 SANTA CLARA DEL NORTE
403 RIO DE SANTA CLARA
404 SANTA CRUZ ISLAND OF
405 SANTA ROSA ISLAND OF
406 GUADALASCA
407 CALLEGUAS
408 EL CONEJO
409 EL ESCORPIO
410 EX-MISSION DE SAN FERNANDO
411 EL ENCINO
412 MISSION SAN FERNANDO
413 TUJUNGA
414 LA CANADA
415 SAN PASCUAL--GARFIAS

CALIFORNIA (CONT.)

416 SAN GABRIEL TR NR--COURTNEY
417 SAN GABRIEL TR NR--LEDESMA
418 LAND 1000 VARAS SQ--SEXTON
419 PROSPERO TRACT
420 SAN GABRIEL TR NR--WHITE
421 HUERTO DE CUATI
422 SAN PASCUAL--WILSON
423 SAN RAFAEL
424 PROVIDENCIA
425 CAHUENGA
426 LOS FELIS
427 LOS ANGELES CITY LANDS OF
428 LAS CIENEGAS
429 LA BREA
430 SAN ANTONIO OR RODEO DE LAS AGUAS
431 SAN JOSE DE BUENOS AYRES
432 SAN VICENTE Y SANTA MONICA
433 TOPANGA MALIBU SEQUIT
434 BALLONA
435 RINCON DE LOS BUEYES
436 CIENEGA O PASO DE LA TIJERA
437 AGUAJE DE LA CENTINELLA
438 SAUSAL REDONDO
439 LOS PALOS VERDES
440 SAN PEDRO--DOMINGUEZ
441 TAJAUTA
442 SAN ANTONIO--LUGO
443 LA MERCED
444 PORTRERO CHICO
445 PORTRERO GRANDE
446 POTRERO DE FELIPE LUGO
447 SAN FRANCISCO--DALTON
448 MISSION SAN GABRIEL
449 SAN GABRIEL TR NR--AGUILAR
450 SAN GABRIEL TR NR--SALES
451 SAN GABRIEL TR NR--SIMEON
452 SAN GABRIEL TR NR--SEXTON
453 SAN GABRIEL TR NR--DOMINGO
454 SANTA ANITA
455 AZUSA--DUARTE
456 AZUSA--DALTON
457 SAN JOSE ADDITION TO
458 SAN JOSE--DALTON ET AL
459 LOS NOGALES
460 LA PUENTE
461 RINCON DE LA BREA
462 LA HABRA
463 SANTA GERTRUDES--COLIMA
464 PASO DE BARTOLO--PICO
465 PASO DE BARTOLO--GUIRADO
466 SANTA GERTRUDES--MCFARLAND & DOWNEY
467 LOS CERRITOS
468 LOS ALIMITOS
469 LA BOLSA CHICA
470 SANTA CATALINA ISLAND
471 LAS BOLSAS
472 LOS COYOTES
473 SAN JUAN CAJON DE SANTA ANA
474 SANTIAGO DE SANTA ANA
475 CANON DE SANTA ANA
476 EL RINCON
477 SANTA ANA DEL CHINO
478 SANTA ANA DEL CHINO ADDITION
479 CUCAMONGA
480 MUSCUPIABE
481 SAN BERNARDINO
482 JURUPA--ROUBIDEAU
483 JURUPA--STEARNS
484 LA SIERRA--SEPULVEDA
485 LA SIERRA--YORBA
486 EL SOBRANTE DE SAN JACINTO
487 SAN JACINTO NUEVO Y POTRERO
488 SAN JACINTO & SAN GORGONIO TRACT BETWEEN
489 SAN JACINTO VIEJO
490 PAUBA
491 VALLEY O TEMECULA
492 TEMECULA
493 SANTA ROSA--MORINO
494 POTREROS SAN JUAN CAPISTRANO
495 LA LAGUNA--STEARNS
496 MISSION VIEJO OR LA PAZ
497 TRABUCO
498 CANADA DE LOS ALISOS
499 LOMAS DE SANTIAGO
500 SAN JOAQUIN (ORANGE)
501 NIGUEL
502 BOCA DE LA PLAYA
503 MISSION SAN JUAN CAPISTRANO 5 TR AT

CALIFORNIA (CONT.)

504 EX-MISSION SAN JUAN CAPISTRANO # TR AT
505 SANTA MARGARITA Y LAS FLORES
506 MONSERATE
507 PAUMA
508 VALLE DE SAN JOSE--PORTILLA
509 SAN JOSE DEL VALLE
510 SANTA YSABEL (SAN DIEGO)
511 VALLE DE SAN FELIPA
512 CUYAMACA
513 CANADA DE SAN VICENTE Y MESA DEL PADRE BARONA
514 VALLE DE PAMO OR SANTA MARIA
515 GUEJITO
516 RINCON DEL DIABLO
517 LOS VALLECITOS DE SAN MARCOS
518 BUENA VISTA
519 GUAJOME
520 EX-MISSION SAN LUIS REY 4 TRACTS
521 AGUA HEDIONDA
522 LOS ENCENITOS
523 SAN DIEGUITO
524 SAN BERNARDO--SNOOK
525 LOS PENASQUITOS
526 SAN DIEGO PUEBLO LANDS OF
527 SAN DIEGO ISLAND OR PENINSULA
528 LA NACION
529 OTAY--ESTUDILLO
530 OTAY--DOMINGUEZ
531 JAMACHO
532 MISSION SAN DIEGO
533 EX-MISSION SAN DIEGO 3 TR AT --CH PR
534 EL CAJON
535 CANADA DE LOS COCHES-INSIDE 534
536 EL CHAMISAL
537 LOS PRIETOS Y NAJALAYEGUA
538 CUCA OR EL POTRER
539 BOCA DE SANTA MONICA
540 ARROYO DE LA LAGUNA
541 JAMUL
542 PUEBLO LOT NO 6
543 CAMARITAS IN SAN FRANCISCO
545 LAS VIRGENES
546 CANADA DE LOS NOGALES
547 PASO DE BARTOLO--MCFARLAND & DOWNEY
548 PASO DE BARTOLO--SEPULVEDA
549 LAS CRUCES
550 EL SOBRANTE
551 CANADA DEL CORTE DE MADERA
552 SAN JOSE Y SUR CHIQUITO
553 ONE SUERTE
554 RESSIGHINI
556 100 VARA LOT AT SAN PEDRO
557 RANCHO AGUAS NIEVES
558 JUAN SILVAS
560 EX-MISSION SAN JOSE COLORADO

001 BEAUBIEN AND MIRANDA
002 LUIS MARIA BACA NO. 4
003* LUIS MARIA B.
004 MONTROSE RES
005 SANGRE DE CRISTO
006 TIERRA AMARILLA
007 ZAPATO
008 DURANGO RESRV
009* SANGRE DE CRI.
010 NOLAN GRANT
011 VIGIL AND SAINT VRAIN
012* VIGIL AND SAINT VRAIN NO. 6

*Alternate representations as entered in the land records.

APPENDIX L.--Named Land Grant Codes--continued

NEW MEXICO

001 AGUA SALADA
003 ALAMEDA
004 ALAMITOS
007 CASA COLORADA
008 ANGOSTURA
010 JOSE SUTTON
011 ANTON CHICO
2012 ANTONIO DE ABEYTA
013 ANTONIO GUTTIERREZ AND JOAQUIN SEDILLO
014 ANTONIO MARTINEZ
015 ANTONIO ORTIZ
018 PEDRO ARMENDARIS
021 ARROYO HONDO
022 ARROYO SECO
024 BARTOLOME FERNANDEZ
025 BARTOLOME SANCHEZ
026 MAXWELL
027 BELEN
028 BERNABE MONTANO
029 BERNALLILO
030 BLACK MESA
031 BOSQUE DEL APACHE
032 M AND S MONTOYA
033 BRAZITO
034 CAJA DEL RIO
035 CANADA DE COCHITI
036 CANADA DE LOS ALAMOS
037 ANTONIO SEDILLO
041 ANTONIO ARMENTA
042 CANON DE CARNUE
043 CANON DE CHAMA
044 CANON DEL AGUA
046 BACA LOCATION NUMBER TWO
047 CANON DE SAN DIEGO
049 NOLAN
050 SALVADOR GONZALES
051 GASPAR ORTIZ
052 CHILILI
056 DONA ANA BEND COLONY
057 MESILLA CIVIL COLONY
058 SANTO TOMAS DE YTURBIDE
059 REFUGIO COLONY
060 JUAN JOSE LOBATO
061 CRISTOVAL DE LA SERNA
062 CUBERO
063 CUYAMUNGUE PUEBLO
064 DABOLOS
068 ELENA GALLEGOS
069 PUEBLO OF SANTA ANA
072 JUAN BATISTA VALDEZ
074 ESTANCIA
076 FELIPE TAFOYA
077 FERNANDO DE TAOS
078 FRANCISCO MONTES VIGIL
079 GALISTEO
080 GIJOSA
081 BENJAMIN EDWARDS
082 GOTERA
087 IGNACIO CHAVEZ
088 JACONA
090 JOHN SCOLLY
091 JUAN DE GABALDON
092 SIERRA MOSCA
093 NUESTRA SENORA DE LA LUZ DE LAS LAGUNITAS
094 LAGUNA PUEBLO
096 LA MAJADA
098 LA SALINA
099 LAS VEGAS
101 LO DE PADILLA
102 LOS CERRILLOS
105 LOS FRIJOLES
107 LOS TRIGOS
108 ANTONIO SALAZAR
110 UNA DE GATO
111 MANZANO
113 MESITA DE JUANA LOPEZ
115 JUAN DE MESTAS
116 MORA
118 NICOLAS DURAN DE CHAVEZ
121 NUESTRA SENORA DEL ROSARIO SAN FERNANDO
124 OJO DEL BORREGO
125 OJO CALIENTE
126 OJO DE LA CABRA
127 OJO DEL ESPIRITU SANTO
129 OJO DE SAN JOSE
130 SAN MATEO SPRINGS
132 ORTIZ MINE
133 PABLO MONTOYA
134 PACHECO
135 PAGUATE PURCHASE
136 PAJARITO
137 PENA BLANCA
138 PETACA

NEW MEXICO (CONT.)

140 PIEDRE LUMBRE
141 PLAZA BLANCA
142 PLAZA COLORADA
143 POLVADERA
144 PRESTON BECK
145 PUEBLO OF ACOMA
146 PUEBLO OF COCHITI
148 PUEBLO OF ISLETA
149 PUEBLO OF JEMEZ
150 PUEBLO OF NAMBE
152 PECOS PUEBLO
153 PUEBLO OF PICURIS
154 PUEBLO OF POJOAQUE
156 PUEBLO OF SANDIA
157 PUEBLO OF SAN FELIPE
158 PUEBLO OF SAN ILDEFONSO
159 PUEBLO OF SAN JUAN
160 JOSE MANUEL SANCHEZ BACA
162 SANTA CLARA PUEBLO
163 PUEBLO OF SANTO DOMINGO
164 PUEBLO OF TAOS
165 PUEBLO OF TESUQUE
166 PUEBLO OF ZIA
167 PUEBLO OF ZUNI
168 RAMON VIGIL
180 RANCHO DEL RIO GRANDE
181 RANCHO EL RIJO
189 RIO COLORADO
192 RIO DE TESUQUE
195 RITO DE LOS
196 SAN ANTONIO DEL RIO COLORADO
197 SAN ANTONIO DE LAS HUERTAS
198 SAN CLEMENTE
199 SAN CRISTOVAL
200 SANGRE DE CRISTO
202 SAN JOAQUIN DEL NACIEMENTO
203 SAN MARCOS PUEBLO
204 SAN MIGUEL DEL BADO
205 SAN PEDRO
206 SANTA BARBARA
207 SANTA CRUZ
208 SANTO DOMINGO DE CUNDIYO
209 SANTE FE
211 SANTA ROSA DE CUBERO
213 SANTA TERESA
216 SANTIAGO RAMIREZ
218 SAN YSIDRO
219 SEBASTIAN DE VARGAS
220 SEVILLETA
221 SITIO DE JUANA LOPEZ
222 SITIO DE LOS CERRILLOS
223 SOCORRO
224 TAJIQUE
225 TALAYA HILL
226 TECOLOTE
227 TEJON
228 TIERRA AMARILLA
229 TOME
230 TORREON
231 TOWN OF ABIQUI
232 TOWN OF ALAMEDA
233 TOWN OF ALBUQUERQUE
237 TOWN OF ATRISCO
241 CEBOLLETA
242 SEBASTIAN MARTIN
243 TOWN OF CHIMITA
245 CIENEGUILLA
250 IGNACIO SANCHEZ VERGASA
251 TOWN OF LOS TRAMPAS
253 LUIS ARMENTA
257 SANTA ANA
258 BALTHAZAR BACA
259 TOWN OF TECOLATE
260 TOWN OF TEJON
262 LAS TRUCHAS
264 VALLECITO
265 BISHOP JOHN LAMY
266 AGUA NEGRA
267 JOSE PEREA
269 ALEXANDER VALLEY
270 ANTONIO CHAVEZ
271 NERIO ANTONIO MONTOYA
272 BACA LOCATION NUMBER ONE
274 JOSE TRUJILLO
275 ANTOINE LEROUX
276 ROGUE LOVATO
278 MARQUEZ AND PADILLA
279 CEBOLLA
280 JOSE F BACA Y TERRUS
281 JOAQUIN MESTAS
283 BACA Y PINO
285 PUEBLO OF SANTA CLARA
286 PUEBLOS OF SANTO DOMINGO AND SAN FELIPE
300 ZIA SANTA ANA AND JEMEZ
301 SERAFIN RAMIREZ
302 PUEBLO OF SANTA ANA

APPENDIX L.--Named Land Grant Codes--continued

OTHER STATES

001 CLARK'S MILITARY (INDIANA)
002 FRENCH (OHIO)
003 FLEMING (FLORIDA)
004 DELESPINE (FLORIDA)
005 ARREDONDO (FLORIDA)
006 MOSES E LEVY (FLORIDA)
007 GOMEZ (FLORIDA)
008 HANSON (FLORIDA)
009 BERNARDO SEGUI (FLORIDA)
010 DOMINGO ACOSTA (FLORIDA)
011 WILLIAM GARVIN (FLORIDA)
012 PETER FOUCHARD (FLORIDA)
013 LUCAS CRAYON (FLORIDA)
014 JOHN H MC INTOSH (FLORIDA)
015 H M GOMEZ (FLORIDA)
016 ANTELM GAY (FLORIDA)
017 PABLO ROSETTE (FLORIDA)
018 JOHN LOW (FLORIDA)
019 JOSEPH WALES (FLORIDA)
020 CHARLES SIBBOLD (FLORIDA)
021 C E MC HARDY (FLORIDA)
022 JOSEPH GAUNT (FLORIDA)
023 GEORGE F CLARK (FLORIDA)
024 JANE MURRAY (FLORIDA)
025 JOHN BOLTON (FLORIDA)
026 SAMUEL BETTS (FLORIDA)
027 AMBROSE HULL (FLORIDA)
028 GERONIMO ALVAREZ (FLORIDA)

National Mapping Program
Technical Instructions
Data Users Guide 3

US GeoData

Digital Line Graphs from 1:2,000,000-Scale Maps

Data Users Guide

Department of the Interior
U. S. Geological Survey

DATA USERS GUIDES

1: Digital Line Graphs from 1:24,000-Scale Maps
2: Digital Line Graphs from 1:100,000-Scale Maps
3: Digital Line Graphs from 1:2,000,000-Scale Maps
4: Land Use and Land Cover Digital Data from 1:250,000- and 1:100,000-Scale Maps
5: Digital Elevation Models
6: Geographic Names Information System
7: Alaska Interim Land Cover Mapping Program

Data Users Guides 1-7 generally replace the Geological Survey Circular 895.

Questions regarding availability and ordering of US GeoData (all types of digital cartographic and geographic data produced and distributed by the U.S. Geological Survey) should be addressed to:

Earth Science Information Center
U.S. Geological Survey
507 National Center
Reston, Virginia 22092
(703)860-6045

Technical questions and comments should be addressed to:

Branch of Technical Management
U.S. Geological Survey
510 National Center
Reston, Virginia 22092

UNITED STATES
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

DIGITAL LINE GRAPHS FROM 1:2,000,000-SCALE MAPS

Data Users Guide 3

Reston, Virginia
1990

First printing, 1986
Second printing (revised), 1990

CONTENTS

Page

Introduction 1
Data content 2
Data structure 2
    Levels of structuring 2
    Topology 2
    Topological elements 3
Attribute codes 3
    Major attribute codes 5
    Minor attribute codes 5
Sample line graph structure 7
Graph theory in DLG data 12
Distribution formats 17
Source materials 18
Cell size and file extent 18
Coordinate systems 18
    Standard distribution format 18
    Optional distribution format 20
    Graphic distribution format 20
Data validation 20
Appendix A. Standard DLG distribution format (record contents) 25
    B. Optional DLG distribution format (record contents) 36
    C. Graphic format 47
    D. Map projection parameters 48
    E. DLG attribute codes 49
    F. Coordinate conversion 58
    G. Sample DLG data file (standard distribution format) 59
    H. Sample DLG data file (optional distribution format) 65
    I. Data sources and currency 70

ILLUSTRATIONS

Page

Figure 1. Map elements showing roads, railroads, buildings, streams, lake and forest areas 4
    2a. Pecos River, Southeastern New Mexico Scale 1:2,000,000 8
    2b. Rivers and water bodies, New Mexico Scale 1:5,000,000 9
    2c. Rivers and water bodies, New Mexico Scale 1:10,000,000 9

ILLUSTRATIONS--continued

Page

Figure 3. Sample line graph 10
4. Window from the Arizona-New Mexico, 1:2,000,000-scale sectional map of the National Atlas of the United States of America 14
5. Sample topology, Catron County, New Mexico 15
6. Multistate cells used for Digital Line Graphs from 1:2,000,000-scale maps 19
7. Location of origin of file reference coordinates 20

TABLES

Page

Table 1. Major codes used for DLG base categories 5
2. Description of the topological elements and relationships of a sample line graph 11
3. Selected sample of standard format DLG-3 records of Catron County, New Mexico [N, node; A, area; L, line] 16
4. Standard, optional, and graphic DLG format 17

DIGITAL LINE GRAPHS FROM 1:2,000,000-SCALE MAPS

INTRODUCTION

The Earth Science Information Centers (ESIC) distribute digital cartographic/geographic data files produced by the U.S. Geological Survey (USGS) as part of the National Mapping Program. Digital cartographic data files may be grouped into four basic types. The first of these, called a Digital Line Graph (DLG), is line map information in digital form. These data files include information on planimetric base categories, such as transportation, hydrography, and boundaries. The second type, called a Digital Elevation Model (DEM), consists of a sampled array of elevations for a number of ground positions that are usually at regularly spaced intervals. The third type is Land Use and Land Cover digital data, which provides information on nine major classes of land use such as urban, agricultural, or forest as well as associated map data such as political units and Federal land ownership. The fourth type, the Geographic Names Information System, provides primary information for all known places, features, and areas in the United States identified by a proper name.

The digital cartographic data files from selected sources currently available from ESIC include the following:

- Digital Line Graphs (DLG)
  --1:24,000-scale
  --1:62,500-scale
  --1:63,360-scale
  --1:100,000-scale
  --1:2,000,000-scale

- Digital Elevation Models (DEM)
  --7.5-minute
  --15-minute
  --30-minute
  --1-degree

- Land Use and Land Cover digital data
  --1:250,000- and 1:100,000-scale Land Use and Land Cover and associated maps
  --1:250,000-scale Alaska Interim Land Cover

- Geographic Names

The digital data are useful for the production of cartographic products such as plotting base maps and for various kinds of spatial analysis. A major use of these digital cartographic/geographic data is to combine them with other geographically referenced data enabling scientists to conduct automated analyses in support of various decisionmaking processes.

Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government. Manuscript approved for publication September 4, 1986.

This document describes DLG's prepared from the 1:2,000,000-scale sectional maps (U.S. regions) of the National Atlas of the United States of America.

DATA CONTENT

The DLG data files derived from the 1:2,000,000-scale maps contain selected base categories of cartographic data in digital form. The data files are derived from the sectional maps of the 1970 National Atlas of the United States of America. The following categories are included in current 1:2,000,000-scale DLG files:

- Boundaries -- This category of data includes boundary information collected in two separate subcategories: (1) Political Boundaries and (2) Administrative Boundaries.
- Hydrography -- This category of data includes features collected in three separate subcategories: (1) Streams, (2) Water Bodies, and (3) Hypsography (Continental Divide only).
- Transportation -- This category of data includes major transportation systems collected in three separate subcategories: (1) Roads and Trails, (2) Railroads, and (3) Cultural Features (airports and Alaska pipeline).

DATA STRUCTURE

Levels of Structuring

The term DLG is employed by the USGS to describe a digital map data set in vector form. Originally, three levels of DLG data (DLG-1, DLG-2, and DLG-3) were proposed; these levels were differentiated by their positional accuracy, level of attribute coding, and relational spatial information. It was found, however, that the widest user-community would be served by producing DLG-3 data, which have the full range of attribute codes and are fully topologically structured. These two properties are required by users whose work includes both graphic and analytic applications. Therefore, all DLG data in the National Digital Cartographic Data Base are level 3.

Topology

Data collection from 1:2,000,000-scale maps was exclusively directed toward producing fully topologically structured level-3 DLG data referred to as DLG-3. The DLG-3 concept is based on graph theory in which a two-dimensional diagram is expressed as a set of nodes (points in space) and links (line segments connecting nodes) in a manner that explicitly expresses logical relationships. Applied to a map, this concept is used to encode the digital data with the spatial relationships among map elements that are obvious when the map is examined visually. The spatial relationships include such concepts as adjacency and connectivity between features on the map. The abstraction of the map data according to the rules of graph theory preserves the spatial relationships inherent in the map graphic and creates a logical and consistent data file structure for computer processing. A digital file of cartographic or geographic data that maintains the spatial relationships inherent in the map is called a topologically structured data file. A topologically structured data file can support simple graphic applications, such as plotting streams and roads for base maps, as well as more advanced applications, such as computations involving areas and lines and their spatial relationships.

Topological Elements

A DLG-3 file is composed of three separate, but related, types of elements: nodes, lines, and areas. Nodes define the location of the end-points of every line, and a single node may mark the start or end of one or more lines. Intersections of linear features and significant points on linear features are marked by nodes because at that point the linear feature is subdivided into line segments.

A line is an ordered set of points that describes the position and shape of a linear feature on the map. Each line starts at a node and ends at a node and, thus, has both an explicit direction and a left-right connotation. The direction of the line is arbitrarily chosen at the time of digitizing. Lines connect to each other at nodes, and, by this definition, a line does not cross itself or any other line. A line may describe the boundary between two map features, such as counties, or may define a map feature by itself, such as a road. A special line, called a degenerate line, is used to define features symbolized as independent points on a map. A degenerate line starts and ends at the same node, has two identical coordinate pairs, has zero length, and is totally enclosed inside one map area.

An area is a portion of the map bounded by lines. All portions of the map must be assigned to some area. Each area is identified in a DLG-3 data file by an arbitrary point chosen to represent the characteristics of the area; the point is not required to be inside the area it represents. Every DLG data file will have at least two areas identified: one representing the area covered by the file and the other representing the area outside the coverage of the file. Additional areas will be defined as necessary to subdivide the area covered by the file. Polygons as unique features are not defined explicitly in a standard DLG file. However, polygons can be constructed using line-area linkages built into the DLG data structure.

ATTRIBUTE CODES

In addition to locational and topological information, DLG data elements may have explicitly encoded attributes. Attribute codes, also called feature codes or classification attributes, are used to describe the map information represented by a node, area, or line. For example, the attribute code for an area might identify a lake or glacier; the attribute code for a line might identify a road, railroad, stream, or shoreline (fig. 1). The codes are based on the cartographic features symbolized on the sectional maps of the 1970 National Atlas of the United States of America.

The map symbology of the source material used during digitizing and encoding of data elements has a strong influence on the overall classification strategy. A listing of all the attribute codes currently assigned and used in the 1:2,000,000-scale DLG files is given in Appendix E.

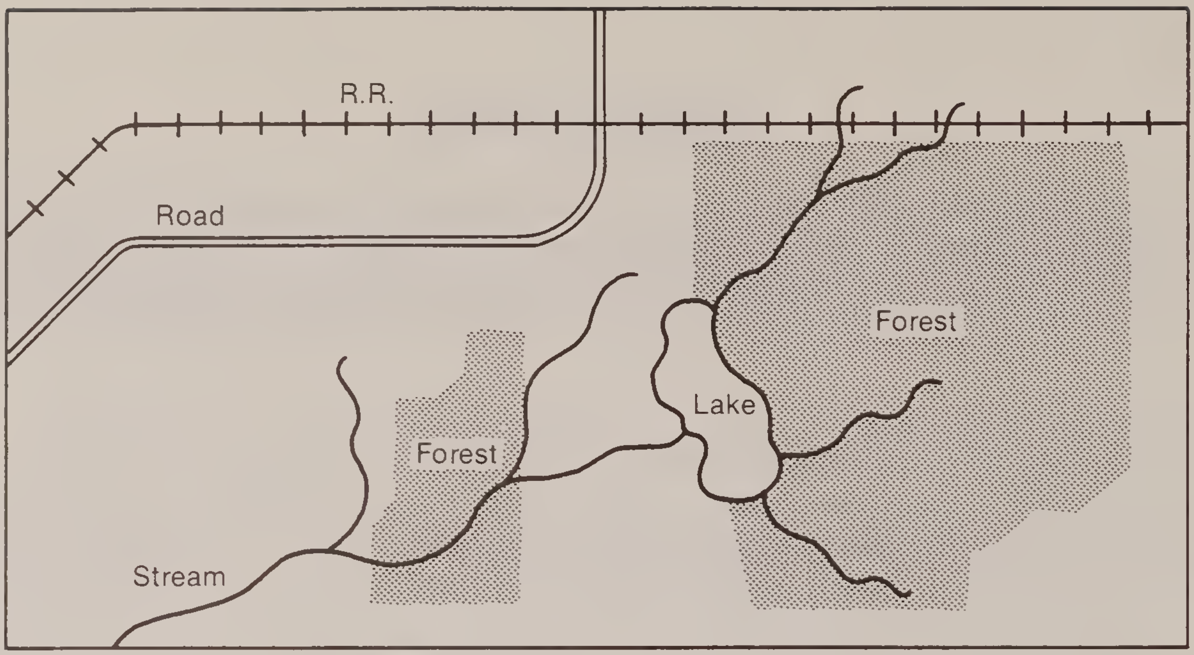


Figure 1.--Map elements showing roads, railroads, buildings, streams, lake, and forest areas.

Each attribute code identifies the major category to which a data element belongs, as well as the specific nature of the element. Codes also may provide additional descriptive information. Most elements are uniquely described by a single attribute code. Others, however, may require two or more codes for a complete description. If multiple attributes are needed to describe an element, the order is not significant. Allowing for a variable number of attribute codes creates an open-ended structure to which information may be added at any time. It is not necessary for each element to have associated attributes; in general, attribute codes are not assigned to an element if the attributes can be derived based on relationships to adjacent elements.

In conventional DLG data files, features are described as they are symbolized or labeled on the source map. For the 1:2,000,000-scale data, however, additional information about the map features is included through a special attribute coding scheme. These codes not only describe the digitized features in a generic sense, but provide a means of selecting map features based on some indices of the significance of the features. These special attribute codes are provided to assist the user in selecting the features to be displayed on maps of various scales and themes. Because of the varying nature of the themes of data digitized, the indices of feature "significance" differs between data overlays.

A DLG attribute code is composed of two distinct numeric fields: a three-digit major code, and a four-digit minor code. In the digital file, the major and minor attributes are encoded in two integer fields of six digits, flush right with leading blanks (FORTRAN 2I6 format). In this document, major codes are presented as three digits, and minor codes are presented as four digits. Leading zeros are shown for clarity; for example: 090 0104.

Major Attribute Codes

A list of the major codes and the categories they represent is contained in table 1. The first two digits of the major code (including leading zeroes) uniquely identify the category to which the described element belongs. The third digit of the major code is used to modify the minor code in two ways:

- If zero, the minor code represents a description or classification of the element.
- If non-zero, the minor code which follows is a parameter requiring special interpretation according to instructions given in the codes for each category (see next section).

Table 1.--Major codes used for DLG base categories

Major Code	Base Category
040	Water Bodies
090	Political and Administrative Boundaries
100	Transportation systems -- Roads and Trails
290	Special line attribute codes for 1:2,000,000-scale data

NOTE: The coding scheme utilizing the major codes 040, 090, 100, and 290 applies only to 1:2,000,000-scale DLG data sets. The codes in the series 040, 090, and 100 are available only in the standard and optional DLG formats (described below). In the graphic data format, only the last two digits of the 290-code series are carried in the data.

Minor Attribute Codes

In the 1:2,000,000-scale data sets, two separate schemes are used to encode minor attribute codes: scheme one is used with the major code series 040, 090, and 100, and scheme two is used with major code series 290. These two schemes will be addressed separately.

Scheme One: Minor Codes in the 040, 090, and 100 Series

The codes in the 040 and 090 code series are used for area elements in the water body and boundary (both political and administrative) categories, respectively. The codes in the 100 code series are applied to the roads and trails category. If the third digit of the major code is zero, the minor code is interpreted to describe the file element in a generic sense (for example, as a lake, forest, or park). If the third digit of the major code is non-zero, the minor code is interpreted as identifying the file element representing part of a particular feature (for example, as the State of Virginia, Fairfax County, or Interstate 95). These codes are not included in the graphic data distribution format.

Examples of these attribute codes include:

040 0100	The major code 040 indicates the water body category. The minor code 0100 identifies the feature as a perennial lake or pond.
090 0104	The major code 090 indicates one of the boundary categories. The minor code 0104 identifies the feature as a national forest or grassland.
091 0051, 092 0059	The major code 091 indicates a State in the boundary category. Because the last digit of the major code is non-zero, the minor code is a parameter. The minor code 0051 is the Federal Information Processing Standards (FIPS) code for the State of Virginia. Similarly, the major code 092 indicates a county in the boundary category. The minor code 0059 is the FIPS code for Fairfax County.
102 0095	The major code 102 indicates an interstate highway in the roads and trails category. Because the last digit of the major code is non-zero, the minor code is interpreted as a parameter code. The minor code 0095 indicates that the element with which this code is associated is part of Interstate 95.

Scheme Two: Minor Codes in the 290 Series

During the planning of the 1:2,000,000-scale data sets, it was decided that the data should support the generation of a variety of maps of different scales and themes. During the process of making different maps, it is necessary to change the amount of data displayed to support the theme or scale of the map. One of these changes is to control the selection of features to be displayed based on some indices of significance or importance.

The 290-code series represents an attempt to encode selected indices of significance or importance in the data. By careful selection of features through the use of these attribute codes, one can control the amount of information displayed.

The minor codes in the 290 series are composed of four digits. The first digit indicates the category of data. The second digit is always zero. The last two digits both identify the feature in a generic sense and contain some index of significance. A description of the minor codes for each numeric series follows:

2000-2099: Hypsography. The only feature currently stored is the Continental Divide.

3000-3099: Streams. Examples of the features encoded include perennial, intermittent, and braided streams, and canals. In addition to the generic description, each feature is further categorized based on an approximate measure of overall feature length. In estimating the length of a feature, the path of a stream was determined by following the named (labeled) channel as far as possible, and then following the longest tributary.

4000-4099: Water Bodies. Examples of these features include perennial, intermittent, and dry lakes. Each feature is further classified by length along the longest dimension of the feature.

5000-5069: Roads and Trails. Examples of these features include Interstate, U.S., and State highways. Each feature is further classified by such characteristics as length, access type (limited or non-limited access), proximity to a parallel route of a higher class, and as serving as a connector in a network of highways of a higher class.

5070-5080: Railroads. Railroads are classified based on a U.S. Department of Transportation classification scheme.

6000-6019: Political Boundaries. Classification is based on a hierarchical scheme of national, State, and county boundaries. Maritime boundary areas are usually closed by unattributed arbitrary extension lines and do not follow the shoreline.

6020-6099: Administrative Boundaries. Examples of these features include national parks, forests, wilderness areas, and Indian reservations. Each feature is further classified by length along the longest dimension of the feature.

7000-7099: Cultural Features (also referred to as Miscellaneous Transportation). Includes civilian and military airports and the Alaskan pipeline. Airports are only available in the standard and optional data distribution formats (refer to the Distribution format section).

An example of the use of these codes to control feature selection is illustrated in figures 2a through c. A map produced at a scale of 1:2,000,000 might include all streams from feature codes 3003 through 3016 and 3008 through 3030 (fig. 2a). A map at a scale of 1:5,000,000 might include streams with a length of greater than 50 kilometers (using feature codes 3007 through 3016 and 3021 through 3030) (fig. 2b).

Finally, at a scale of 1:10,000,000, a map might only display those features with a length greater than 100 kilometers (using codes 3010 through 3016 and 3024 through 3030) (fig. 2c).

These figures also illustrate the use of the "centerline in water body" codes (3035 through 3059). In generating a graphic of drainage for an area, normally data from both the stream and water body overlays is portrayed. When controlling the number of water bodies displayed in a graphic, it is possible that gaps will appear in a stream network where small bodies of water were not selected for display. The "centerline in water body" codes were meant to fill these gaps. For example, the codes were designed so that, if perennial lakes of length of 2 to less than 4 kilometers (code 4002) were not selected for display, the centerline in perennial lakes of 2 to less than 4 kilometers (code 3036) would be selected to maintain connectivity in the stream network. Unfortunately, these centerline codes only reference the body of water in which they reside and not the stream to which they are connected. It is possible that centerlines might be requested for display and the stream to which they connect not be selected for display.

SAMPLE LINE GRAPH STRUCTURE

Examples of a line graph and its corresponding digital records are given in figure 3 and table 2. These examples are simplified representations of the concepts used in the DLG-3 structure; they are not actual data files. The example shown is composed of 13 nodes, labeled N1 through N13, 5 areas, labeled A1 through A5, and 15 lines, labeled L1 through L15. Each element type is maintained as a separate list in the digital data.

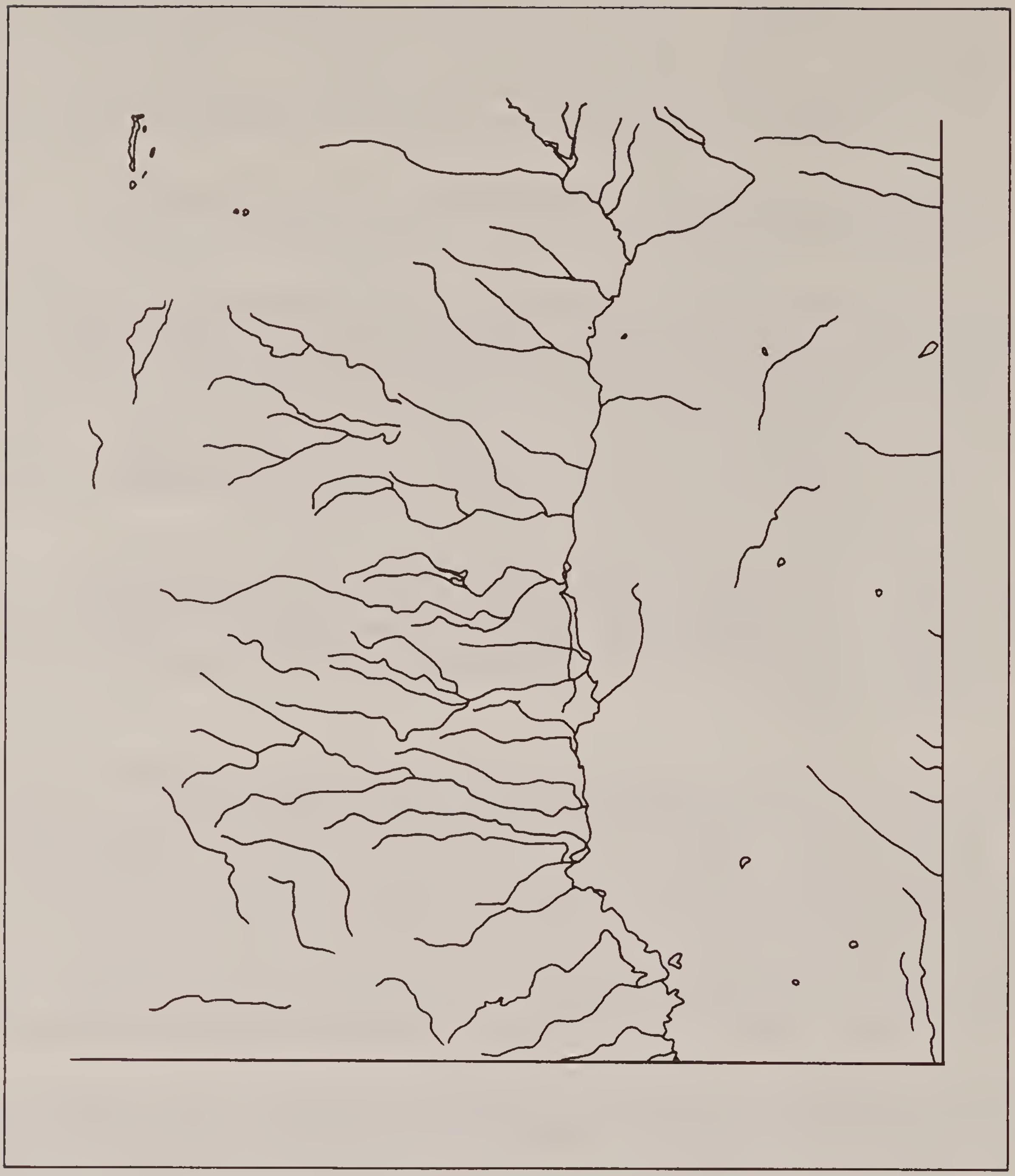


Figure 2a.--Pecos River, southeastern New Mexico.
Scale: 1:2,000,000.

The map represented by the example is divided into five distinct areas. Area A1 represents the area outside of the map border. There is one outside area for each DLG-3. It is always the first area encountered and has the attribute code 000 0000. In the example given in figure 3, the portion of the map inside the border is divided into four areas, each bounded (closed) by lines. Area A2 is bounded by lines L14, L1, L4, and L5. Area A3 is bounded by lines L3, L13, L4, L6, L7, L8, L15, and L9. Area A4 is bounded by lines L8, L15, and L9. Area A5 is bounded by lines L5, L6, L7, and L10 and L2.

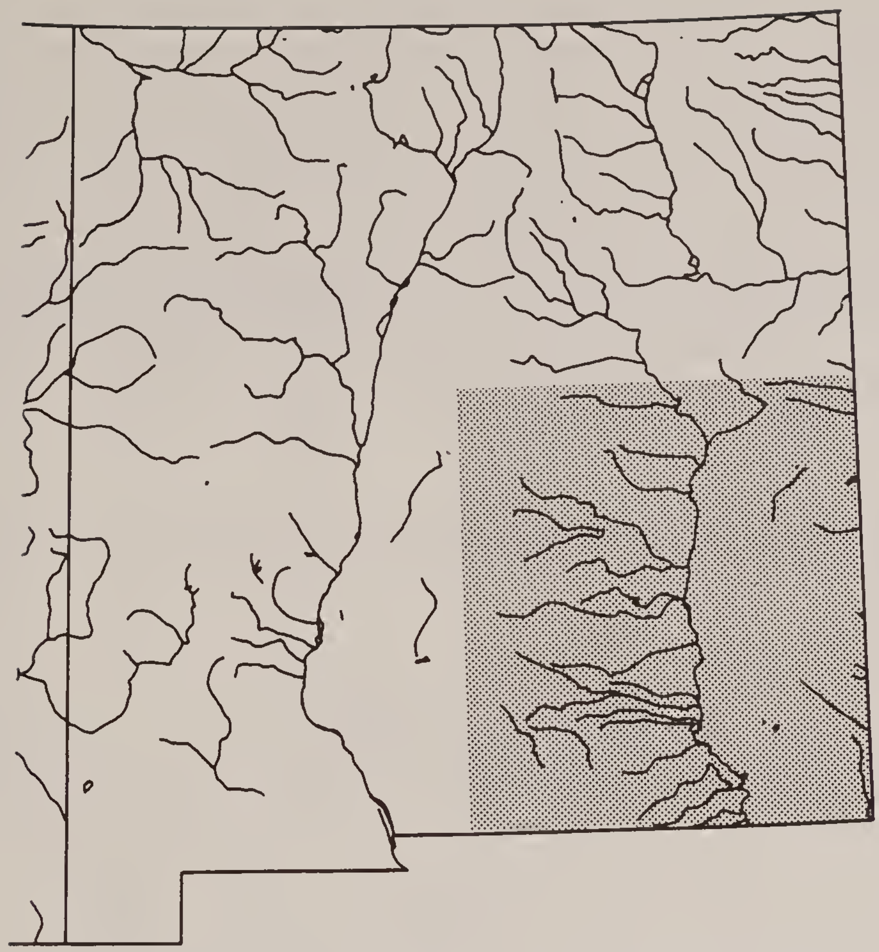


Figure 2b.--Rivers and water bodies, New Mexico.
Scale: 1:5,000,000.

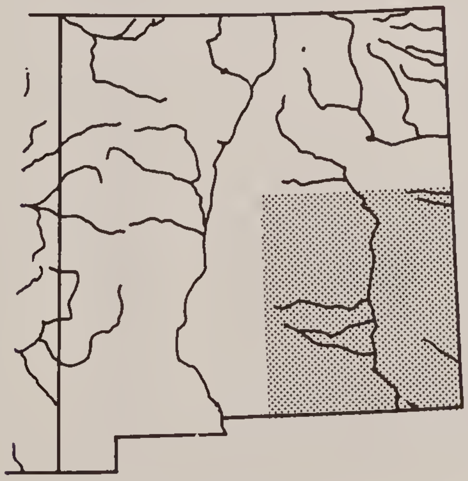


Figure 2c.--Rivers and water bodies, New Mexico.
Scale: 1:10,000,000.

In this example, line elements contain the only explicit topological references. Each line contains pointers to its bounding nodes (starting and ending) and the areas that it bounds (left and right of the line). This format is similar in concept to the standard DLG-3 data structure, which minimizes redundant linkages to achieve efficient data encoding and storage.

The lines in figure 3 are labeled L1 through L15. The lines can be identified by their starting node number, ending node number, number of the area to the left of the direction of travel, number of the area to the right of the direction of travel, and string of coordinates describing the alignment of the line. In this example, only two pairs of coordinates are shown; however, in an actual file, an irregular line would have a variable number of coordinate pairs up to a limit of 1,500 coordinate pairs. The direction of travel of the line is arbitrarily determined during the digitizing operation. In this example, L1 is encoded as proceeding clockwise around area A2. Thus line L1 starts at node N1, ends at node N3, has area A1 to the left of the direction of travel, and has area A2 to the right of the direction of travel. The coordinate string describing the alignment of the line will start with the same coordinate values as that of node N1 and will end with the same coordinate values as that of node N3. Because the area to the left of its direction of travel, A1, is different from the area to the right of its direction of travel, A2, the line is known to be a boundary between the two areas.

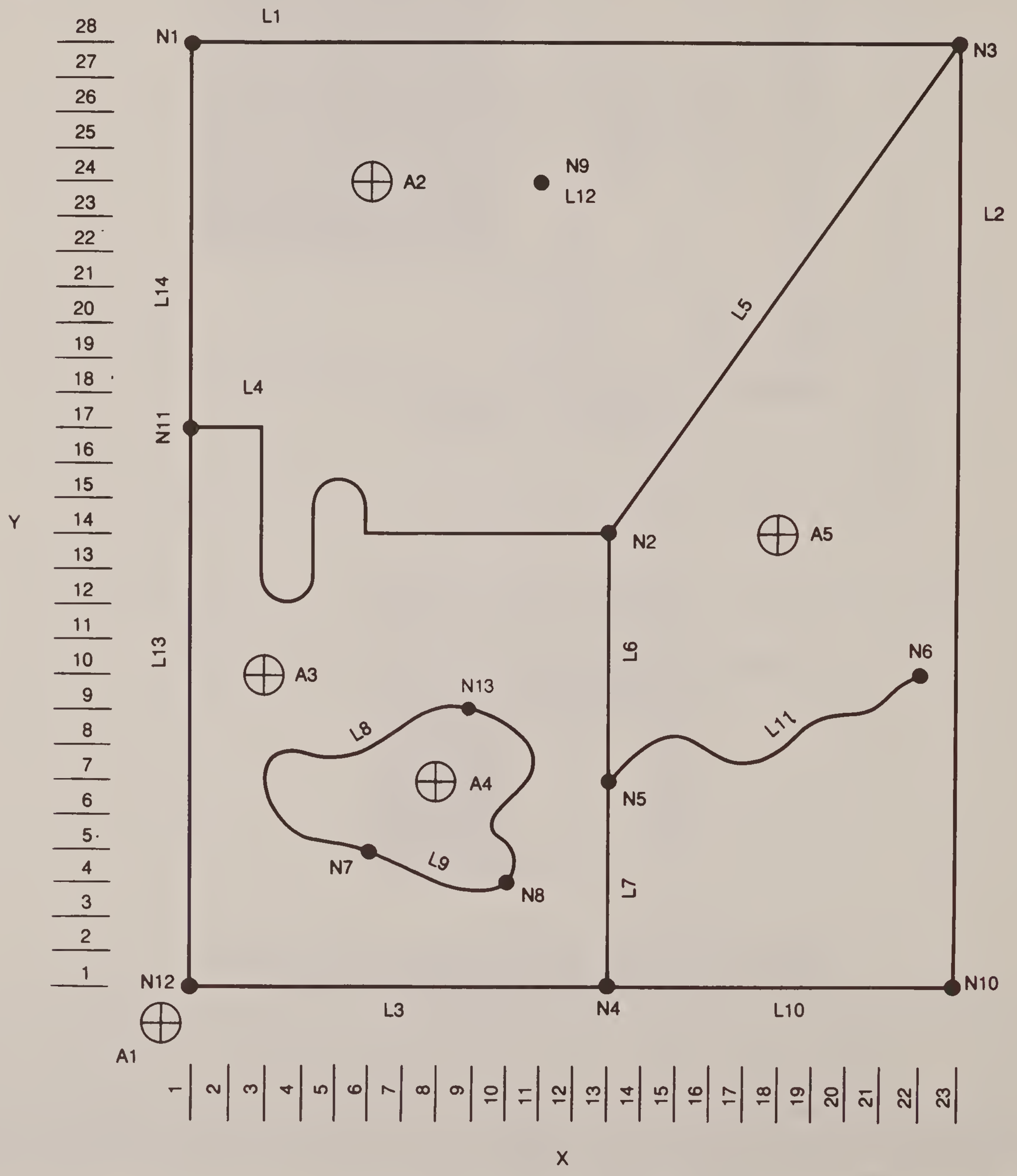


Figure 3.--Sample line graph.

Table 2.--Description of the topological elements and relationships of a sample line graph (see fig. 3)

Nodes

Internal Id Number	X Coordinate	Y Coordinate
N1	1	28
N2	13	14
N3	23	28
N4	13	1
N5	13	7
N6	22	10
N7	6	5
N8	10	4
N9	11	24
N10	23	1
N11	1	17
N12	1	1
N13	9	9

Areas

Internal Id Number	X Coordinate	Y Coordinate
A1	0	0
A2	6	24
A3	3	10
A4	8	7
A5	18	14

Lines

	Nodes		Area		Coordinates	
Number	Starting	Ending	Left	Right	(first x y	last x y)
L1	1	3	1	2	1, 28	23, 28
L2	3	10	1	5	23, 28	23, 1
L3	4	12	1	3	13, 1	1, 1
L4	11	2	2	3	1, 17	13, 14
L5	2	3	2	5	13, 14	23, 28
L6	2	5	5	3	13, 14	13, 7
L7	5	4	5	3	13, 7	13, 1
L8	13	7	4	3	9, 9	6, 5
L9	7	8	4	3	6, 5	10, 4
L10	4	10	5	1	13, 1	23, 1
L11	5	6	5	5	13, 7	22, 10
L12	9	9	2	2	11, 24	11, 24
L13	12	11	1	3	1, 1	1, 17
L14	11	1	1	2	1, 17	1, 28
L15	8	13	4	3	10, 4	9, 9

Lines L11 and L12 are examples of lines that lie within one area. In this example, line L11 starts at node N5, ends at node N6, has area A5 to the left of the direction of travel, and again has area A5 to the right of the direction of travel. The coordinate string for the line will start with the same coordinate values as that of node N5 and will end with the same coordinate value as that of node N6. Line L12 is an example of a degenerate line. The line starts at node N9, ends at node N9, and has area A2 as both the area to its left and right. There are only two coordinate pairs in the string defining the line: both points have the same coordinate values as node N9; thus, the two points are the same and the line has zero length.

The line graph concept allows all of the points on the map to be described as a member of a line graph element (node, area, or line) with minimal redundancy. The relationships between the various elements are indicated by the structure. Note that in this example the x and y coordinates are numbered from the lower left corner to simplify the drawing. In an actual DLG-3 file, the origin is the center of the map and the internal file coordinates are numbered plus or minus 1 to 32,767 expressed in thousandths of inches. See the section labeled "Coordinate Systems" for more detail.

GRAPH THEORY IN DLG DATA

There are two ways to implement the line graph concept in DLG files: the area case and the network case. These cases are differentiated by the nature of the information contained in the categories.

Area line graphs are used to represent areal features such as political entities or water bodies. Area line graphs correspond directly to the general line graph case in that each closed area on the map is represented by a distinct area element. Data categories that are collected as area line graphs include:

- Political Boundaries
- Administrative Boundaries
- Water Bodies

Network line graphs are used to represent linear features in digital form. The network case differs from the area case in that, irrespective of the number of closed areas forming the graph, only two area elements are encoded: (1) the area outside the graph, termed the outside area; and (2) the area within the graph, termed the background area. All lines except the graph boundary are considered to be contained within the background area. The major topological relationship expressed by network data is that of connectivity. Data encoded in network line graph form are suitable for various forms of network analysis, such as minimum path computations. Data categories that can be collected as network line graphs include:

- Roads and Trails
- Railroads
- Cultural Features
- Streams
- Hypsography (Continental Divide only)

In the area case, such as the boundary data collected from 1:2,000,000-scale maps, all areas on the graph have an identity pertinent to the category and are assigned attribute codes to describe them. The lines in such cases derive their significance from the areas they border. In the network case, as implemented in roads and trails collected from 1:2,000,000-scale maps, the lines themselves have the identity and are assigned attribute codes to describe them. The background area, represented by a single area record, does not have an attribute code assigned to it.

Figure 4 shows a window in the vicinity of Catron County, New Mexico, taken from the Arizona and New Mexico 1:2,000,000-scale map. Figure 5 shows the line graph encoded for the boundaries of the same area. Certain nodes, areas, and lines are labeled.

Table 3 contains some of the digital data records extracted from the node, area, and line lists which describe this portion of the graph. (Note: Descriptions of DLG-3 formats are contained in Appendixes A, B, and C, and a list of attribute codes is contained in Appendix E.)

In the example, each node and area element is described by one or two logical records: (1) a type D.1 record that describes the element, and (2) an optional type F record that lists the attribute codes associated with the element. The first record (type D.1) for each node and area element contains the following fields:

1. Type of record indicator, N for node or A for area.
2. Internal sequence identification number.
3. x coordinate of node or representative area point.
4. y coordinate of node or representative area point.
5. Number of attribute codes that describe the element.
6. Number of pairs of characters in the text string that describes the element.

The second record (type F) for each node and area element contains n attribute codes (expressed as major and minor code pairs), where n is the number specified in field 5 of the first (type D.1) record.

Each line element in the example is described by two or three logical records: (1) a type D.2 line description record, and (2) a type E record that lists the x,y coordinate pairs that define the shape of the line, and, if appropriate, (3) a type F (attribute code) record. The first record (type D.2) for each line element contains the following fields:

1. Type of record indicator (L).
2. Internal sequence identification number.
3. Internal sequence number of starting node.
4. Internal sequence number of ending node.
5. Internal sequence number of the area to the left of the line.
6. Internal sequence number of the area to the right of the line.
7. Number of x,y coordinate pairs that locate the line on the map.
8. Number of attribute codes that describe the line.
9. Number of pairs of characters in the text string that describes the line.

The second logical record (type E) for each line element contains n coordinate pairs, where n is the number specified in field 7 of the first (type D.2) record. The type F record is as described above.

The topological pointers contained in the DLG-3 line elements enable a user to manipulate the data based on the spatial relationships. For example, some applications require areal data to be expressed as closed strings of x,y coordinate pairs. For such applications the user can request that the data be supplied in the optional distribution format. In this format the references to the boundary lines of each area are explicitly coded into the area record. For other applications the standard format may be preferable.

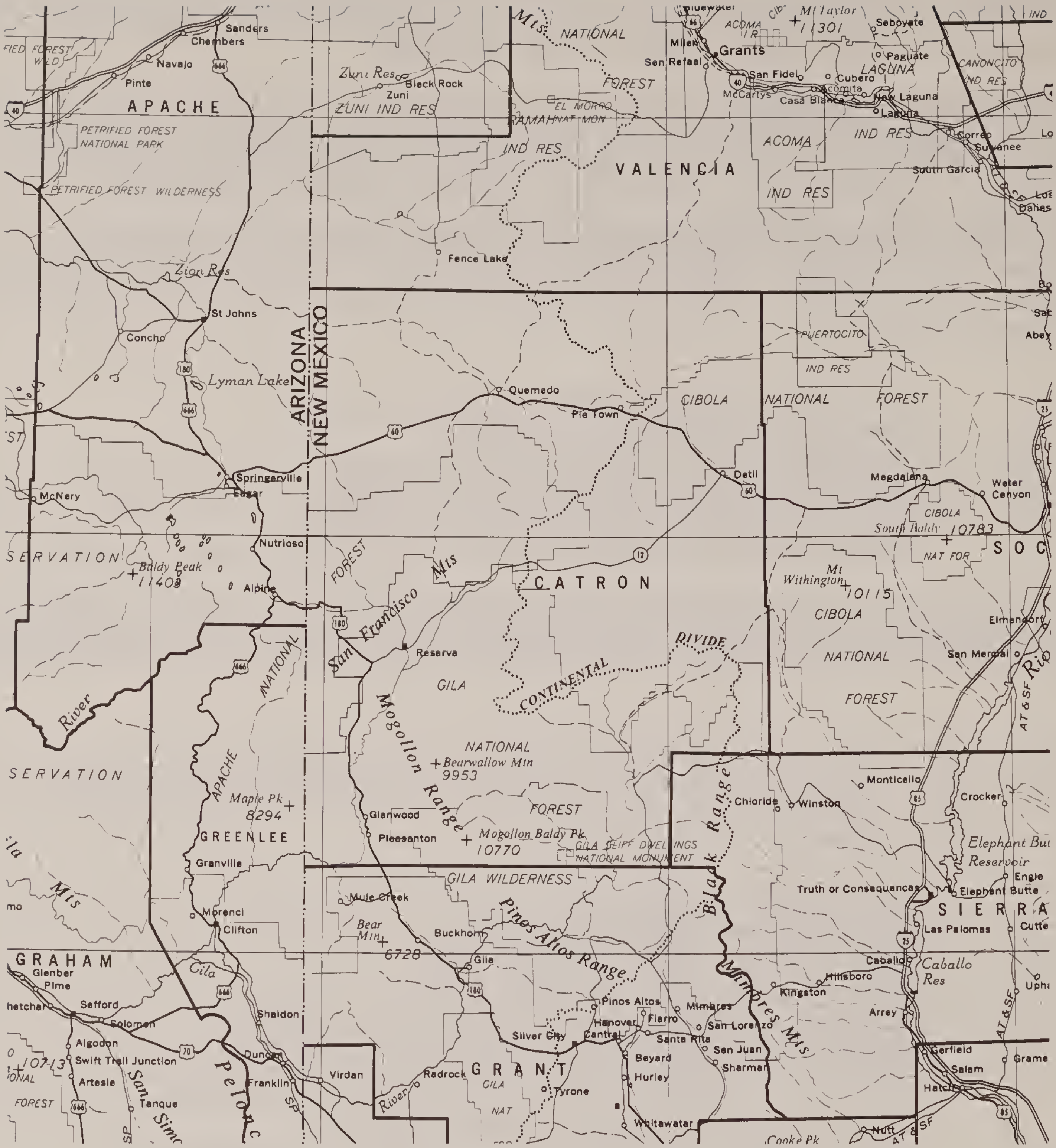


Figure 4.--Window from the Arizona-New Mexico, 1:2,000,000-scale sectional map of the National Atlas of the United States of America.

The specific records in table 3 describe Catron County, New Mexico. The county is described by 6 nodes, 1 area, and 6 lines. The area information, encoded in area record 10, includes the position of the area record (428, -934) and the attribute codes 091 0035 and 092 0003 identifying the area as being in the State of New Mexico and Catron County respectively. The boundary of the county is formed by lines 76, 79, 80, 85, 86, and 87. They can be verified as forming the boundary of this area by noting that each line has area 10 as the area to the left or right of the direction in which the line was digitized. In addition, the lines have attribute codes identifying them as portions of State boundaries (code 290 6005) or county boundaries (290 6009). The lines may be connected to form a closed loop around the area. This may be accomplished by reordering the line elements in a clockwise direction (where area 10 is always to the right of the direction of travel) or in a counterclockwise direction (where area 10 is always to the left of the direction of travel). (In reordering the direction of a line element, the starting node becomes the ending node (and vice versa), the area left becomes the area right (and vice versa), and the points describing the line are reordered (the first point becomes the last point, the second point becomes the second to the last point, etc.).) Once the lines are ordered correctly, the lines may be connected by using the starting and ending node information. Island-like features must be handled separately. Users whose applications will require this sort of structure should consider purchasing the optional format of the DLG data, which contains these forward and inverse pointers between lines and area and line and nodes.

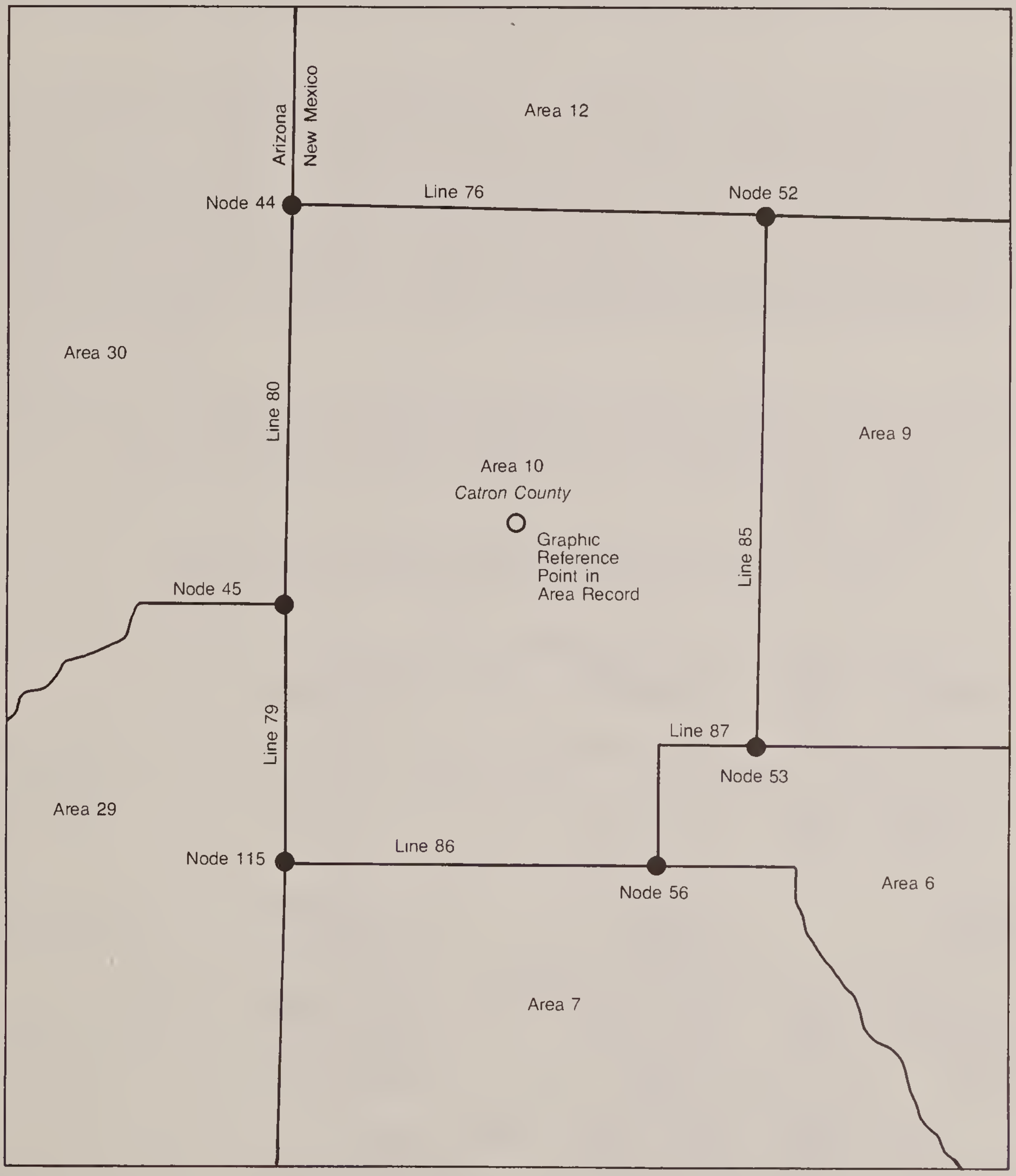


Figure 5.--Sample topology, Catron County, New Mexico.

Table 3.--Selected sample of standard format DLG-3 records of Catron County, New Mexico [N, node; A, area; L, line]

```
N      44   -86   948     0     0
N      45   -90  -831     0     0
  .
  .
  .
N      52  2297   947     0     0
N      53  2361 -1484     0     0
  .
  .
  .
N      56  1840 -2085     0     0
  .
  .
  .
N     115   -91 -2102     0     0
  .
  .
  .
A      10   428  -934     2     0
     91    35    92     3
  .
  .
  .
L      76    44    52    12    10     4     1     0
   -86   948  1155   938  1565   940  2297   947
   290  6009
  .
  .
  .
L      79   115    45    29    10     3     1     0
   -91 -2102   -91 -1770   -90  -831
   290  6005

L      80    45    44    30    10     3     1     0
   -90  -831   -86     8   -86         948
   290  6005
  .
  .
  .
L      85    53    52    10     9     4     1     0
  2361 -1484  2329  -706  2319   252  2297   947
   290  6009

L      86   115    56    10     7     3     1     0
   -91  2102   195 -2091  1840 -2085
   290  6009

L      87    56    53    10     6     4     1     0
  1840 -2085  1842 -1482  2285 -1484  2361 -1484
   290    6009
```

DISTRIBUTION FORMATS

The 1:2,000,000-scale DLG data are available in three distribution formats: (1) standard, (2) optional, and (3) graphic.

The standard distribution format was designed to minimize storage requirements. Explicit topological linkages are contained only in the line elements. A sample DLG data file in standard format is illustrated in Appendix G.

The optional distribution format was designed for data interchange. These files are typically larger than those in the standard format but, for certain applications, can simplify processing requirements. Topological linkages are explicitly encoded between all line and node elements, and all line and area elements. This structure allows a polygon data structure to be easily created. A sample DLG data file in optional format is illustrated in Appendix H.

The graphic distribution format was designed to be compatible with the GS-CAM (Geological Survey - Cartographic Automatic Mapping) software. This software provides for plotting line and point information using a variety of map projections, scales, and graphic symbologies. To obtain information on the availability of the GS-CAM software, please refer to the inside front cover of this publication. The files in the graphic distribution format are derived from the topologically structured DLG data described above, and contain a subset of the line and attribute code information in the DLG files. No node or area information is stored in these files. These files are not topologically structured.

The characteristics of the standard, optional, and graphic DLG formats are summarized in table 4.

Table 4.--Standard, optional, and graphic DLG format

	Standard	**Optional**	**Graphic**
Character set	8-bit ASCII	8-bit ASCII	8-bit ASCII
Logical record length	144 bytes	80 bytes	20 bytes
Physical record length (blocksize)	variable in multiples of 144 bytes	variable in multiples of 80 bytes	variable in multiples of 20 bytes
Coordinate system	internal file (thousandths of a map inch)	ground planimetric (Albers Equal-Area Conic)	geographic (latitude and longitude)
Topological linkages	contained only in line elements	contained in node, area, and line elements	none (only contains line elements)

These formats are described in detail in Appendixes A, B, and C.

SOURCE MATERIALS

The data described in this document are derived from USGS 1:2,000,000-scale reference maps from The National Atlas of the United States of America. Selective updating of the maps was done prior to digitizing. Data source and currency information may be found in Appendix I.

The data for the conterminous United States and Hawaii were collected from 1:2,000,000-scale map manuscripts. For Alaska, the boundary and transportation data were digitized from 1:2,000,000-scale source documents; the hydrographic data were digitized from 1:1,000,000-scale source documents. The scale of the source materials used to generate a DLG is contained in the file header. The scale is also reflected in the resolution field, which states the ground length in meters of the smallest data collection unit 0.001 inch (50.8 meters for 1:2,000,000-scale data; 25.4 meters for 1:1,000,000-scale data).

CELL SIZE AND FILE EXTENT

The DLG's are distributed predominantly in multistate cells (fig. 6). There are a total of 21 cells for the United States: 15 for the conterminous United States, 5 for Alaska, and 1 for Hawaii. In general, States are not divided between cells. Three States (California, Texas, and Montana) are divided between two cells along county boundaries. Alaska is divided among five cells along arcs of longitude and/or latitude.

The data for each cell are encoded in multiple thematic categories (Political Boundaries, Administrative Boundaries, Roads and Trails, Railroads, Cultural Features, Streams, Water Bodies, and (where appropriate) Hypsography). Normally, there is one file per category. Due to software limitations at the time of digitizing, however, some categories with a large number of elements may be encoded in several files. Files are not horizontally integrated (edge joined) between cells.

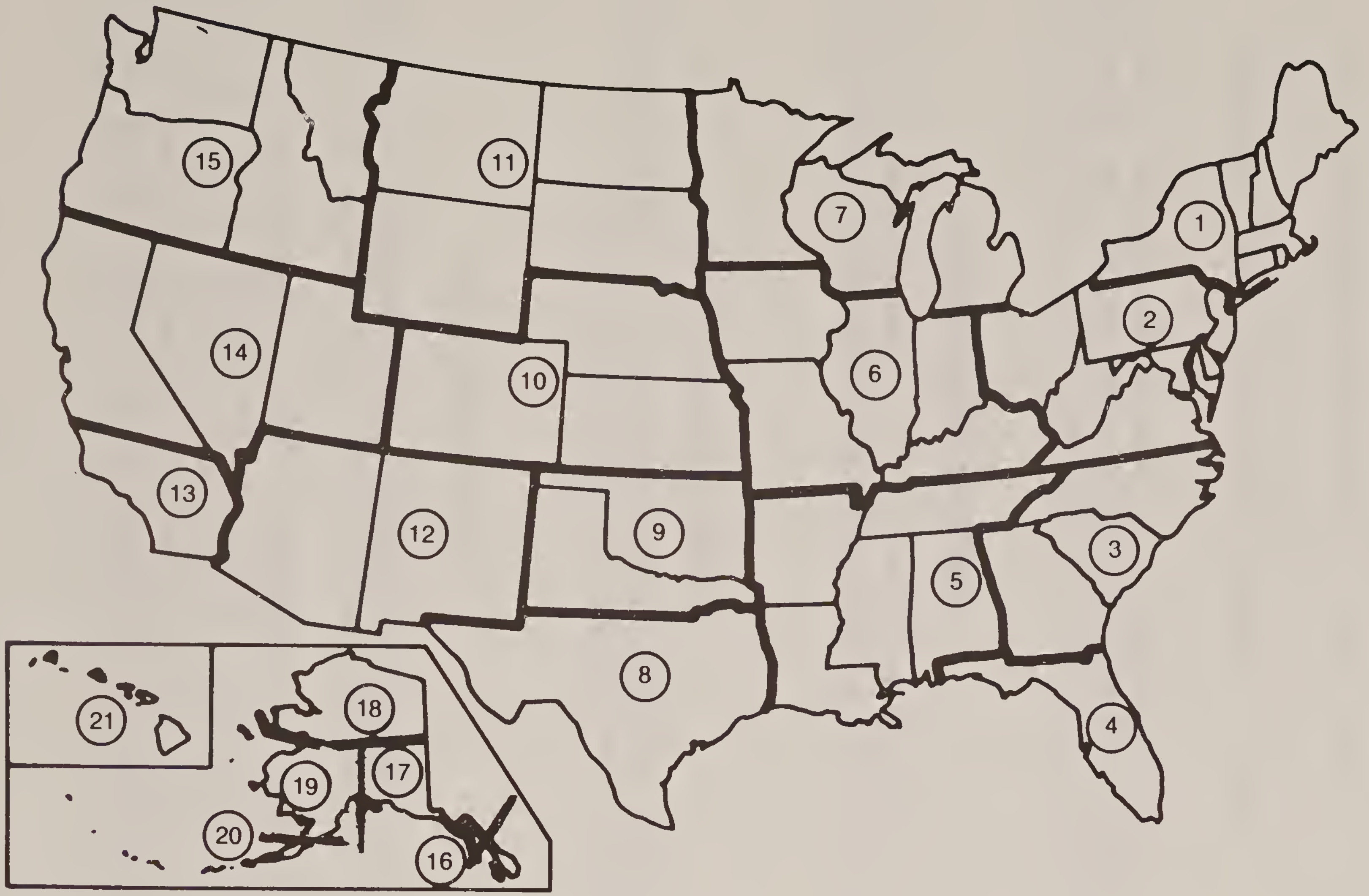
COORDINATE SYSTEMS

The positional descriptions for DLG data elements are expressed in one of three coordinate systems, dependent upon the distribution format selected. These distribution formats - standard, optional, and graphic - are described below.

Standard Distribution Format

The DLG data in the standard distribution format are encoded using an internal file coordinate system to minimize storage requirements. The characteristics of this system are as follows:

1. The coordinate system is Cartesian.
2. The origin (x=0, y=0) is at the center of the cell (fig. 7).
3. The x-axis of the coordinate system is parallel to a theoretical straight line connecting the southwest and southeast registration points of the cell, y-axis is perpendicular to that line.
4. One unit is equal to 0.001-inch at map scale.
5. The coordinate domain is limited to the range -32768 to +32767.



INDEX MAP

1	NORTHEASTERN STATES
2	MIDDLE ATLANTIC STATES
3	SOUTHEASTERN STATES
4	FLORIDA
5	SOUTHERN MISSISSIPPI VALLEY STATES
6	CENTRAL MISSISSIPPI VALLEY STATES
7	NORTHERN GREAT LAKES STATES
8	SOUTHERN TEXAS
9	SOUTHERN PLAINS STATES
10	CENTRAL PLAINS STATES
11	NORTHERN PLAINS STATES
12	ARIZONA AND NEW MEXICO
13	SOUTHERN CALIFORNIA
14	CENTRAL PACIFIC STATES
15	NORTHWESTERN STATES
16	SOUTHEASTERN ALASKA
17	CENTRAL ALASKA
18	NORTHERN ALASKA
19	SOUTHWESTERN ALASKA
20	ALEUTIAN ISLANDS
21	HAWAIIAN ISLANDS

Figure 6.--Multistate cells used for Digital Line Graphs from 1:2,000,000-scale maps.

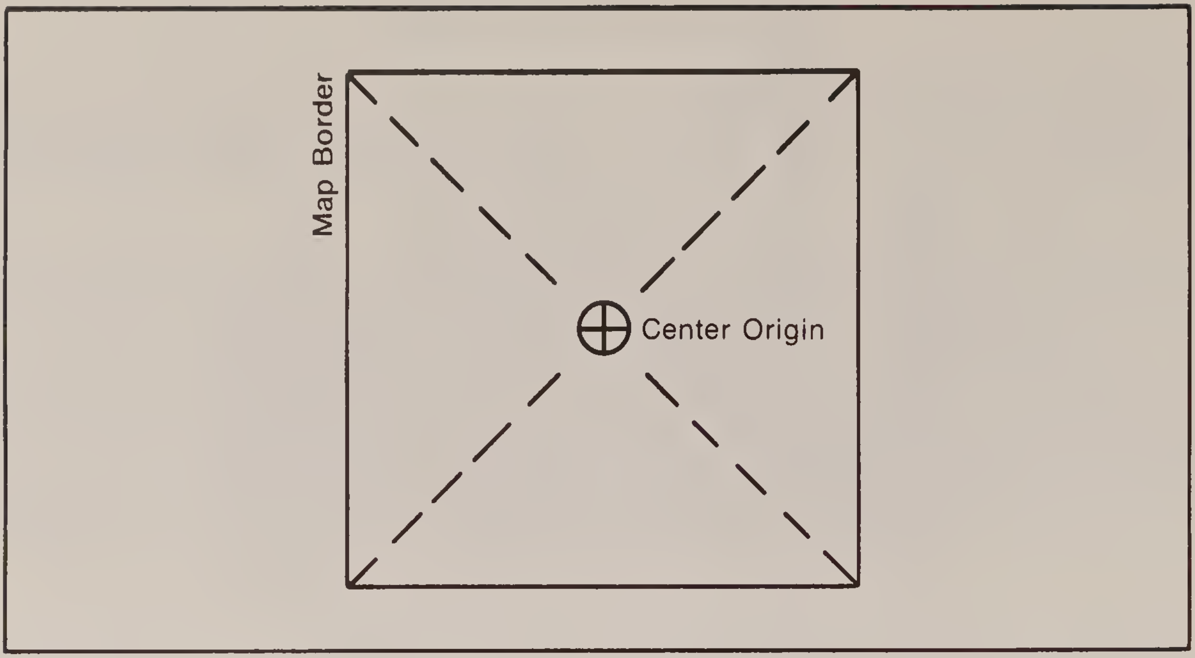


Figure 7.--Location of origin of file reference coordinates.

The file header contains the parameters of a transformation which can be used to convert the internal file coordinates to the ground coordinate system, which is the Albers Equal-Area Conic Projection for 1:2,000,000-scale DLG's. An example of this transformation is given in Appendix F.

Optional Distribution Format

The DLG data in the optional distribution format are expressed in the units of the ground coordinate system, that is, meters in the Albers Equal-Area Conic coordinate systems described in Appendix D.

Graphic Distribution Format

The data in the graphic distribution format are expressed in geographic coordinates (latitude-longitude). These values are expressed in degrees-minutes-seconds.

DATA VALIDATION

The DLG data do not currently carry quantified accuracy statements. The following procedures, however, are used to validate the data files before they are released for distribution:

1. File fidelity and completeness -- The data are manually digitized using equipment with a resolution of 0.001 inch and an absolute accuracy of from 0.003 to 0.005 inch. The positional accuracy of the data and completeness of the file are checked by visually comparing proof plots with the original stable-base source material. These proof plots are generated using automated drafting machines with a resolution of 0.001 inch and an absolute accuracy of from 0.003 to 0.005 inch.

2. Attribute accuracy -- Validating the codes for correct application is currently a manual process involving the correlation of formatted listings with proof plots.

3. Topological fidelity -- The topological structure of each DLG file is fully validated by software. There are no extraneous intersections; that is, a line does not join or cross another line, or itself, except at a node. No line extends through a node. Polygon (area) adjacency is also validated; that is, area left and right topological attributes of lines are consistent throughout the file. The neatline is free of gaps. Validation of DLG data is performed for each category within a file.

   [Note: A deficiency in the topological validation software was discovered after the data were processed. For some graphic representations the software did not check the topology of island-like features correctly; some features of this type may have incorrect topology in the files.]

APPENDIXES

APPENDIX A.--Standard DLG Distribution Format (Record Contents)

In the standard DLG distribution format, the topological linkages are contained only in the line elements. The files are physically comprised of standard 8-bit ASCII characters organized into fixed-length logical records of 144 characters. Nine distinct record types are defined.

Logical record type	Content
A	Header record containing DLG identification information.
B	Header record containing projection information and registration points.
C	Header record identifying data categories contained in this DLG and indicating the number of nodes, areas, and lines in each category.
D.1	A node or an area record.
D.2	A line record.
E	Record containing x,y coordinate string.
F	Record containing attribute codes.
G	Record containing text string (not currently used).
H	Accuracy estimate (not currently used).

The actual sequence of records in a standard distribution DLG file is as follows:

1. Header records
    - Type A (one record)
    - Type B (one record)
    - Type C (one record)
2. Data records
    - Node records
        - Node description (D.1)
        - Attribute codes (F)
        - Text string (G)

      Repeated for each node within a data category
    - Area records
        - Area description (D.1)
        - Attribute codes (F)
        - Text string (G)

      Repeated for each area within a data category
    - Line records
        - Line description (D.2)
        - x,y coordinates (E)
        - Attribute codes (F)
        - Text string (G)

      Repeated for each line within a data category

   Repeated for each data category
3. Accuracy estimate
    - Type H (one record) (not currently used)

Descriptions of the contents of records A-F are contained in the following tables. The tables also reflect the relationship between these record types and 144-byte logical records.

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

[Integer fields with a value of zero will have leading zeros suppressed. For example, an I6 field would be "bbbbb0". (b = blank)]
[Any field with the format of D24.15 which has a value of zero will be represented as "bbb0.0bbbbbbbbbbbbbbbbb", the last four positions of the fractional portion being reserved for a decimal exponent. (b=blank)]

Logical Record Type A

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
A.1	1	Name of digital cartographic unit	ALPHA	A40	1	40	The name of the map will be used when practical.
---	---	Filler	---	---	41	41	1 space
A.1	2	Date of original source materials	ALPHA	A10	42	51	Year of original source material, followed by latest revision date if applicable, for example, 1956, 1965.
---	---	Filler	---	---	52	52	1 space
A.1	3	Scale of original source material	INTEGER*4	I8	53	60	Scale denominator of source material, for example, 2000000.
---	---	Filler	---	---	61	144	84 spaces
A.2	1	DLG level code	INTEGER*2	I6	1	6	Code=3, DLG-3
A.2	2	Code defining ground planimetric reference system	INTEGER*2	I6	7	12	Code=3, Albers Equal-Area Conic projection
A.2	3	Code defining zone in ground planimetric reference system	INTEGER*2	I6	13	18	Code=9999

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type A--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
A.2	4	Map projection parameters	REAL*8	5D24.15	19	138	This field contains the first 5 of 15 map projection parameters. Parameters for the Albers Equal-Area Conic projection are given in Appendix D.
---	---	Filler	---	---	139	144	6 spaces
A.3	1	Map projection parameters	REAL*8	6D24.15	1	144	This record contains projection parameters 6 thru 11. Parameters for the Albers Equal-Area Conic projection are given in Appendix D.
A.4	1	Map projection parameters	REAL*8	4D24.15	1	96	This field contains the last 4 projection parameters. Parameters for the Albers Equal-Area Conic projection are given in Appendix D.
A.4	2	Code defining units of measure for ground planimetric coordinates throughout the file	INTEGER*2	I6	97	102	Code=2, meters
A.4	3	Resolution	REAL*8	D24.15	103	126	The true ground distance corresponding to one unit (0.001 inch at map scale) in the file internal reference system. For 1:2,000,000-scale 0.001 inch equals 50.8 meters.

Logical Record Type A--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
A.4	4	Accuracy code of planimetric data	INTEGER*2	I6	127	132	Code=0, unknown accuracy
A.4	5	Number (n) of registration points	INTEGER*2	I6	133	138	n=4
---	---	Filler	---	---	139	144	6 spaces
A.5 A.6	1	A (4,2) array containing geographic coordinates of the registration points	REAL*8	3(2D24.15) 2D24.15	1 1	144 48	Coordinates are in geographic longitude and latitude in units of degrees and decimal degrees and are expressed in the order=SW, NW, NE, SE.
---	---	Filler	---	---	49	144	96 spaces

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type B

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
B.1	1	Parameters (A1, A2, A3, A4) of file-to-ground projection transformation; the explicit form of the transformation is: X=A1x+A2y+A3 Y=A1y-A2x+A4 where: x,y are coordinates in file internal reference system X,Y are coordinates in map projection reference system	REAL*8	4D24.15	1	96	X,Y coordinates resulting from this transformation will be in ground meters in the Albers Equal-Area Conic projection coordinate system defined by the data elements in records A.2 - A.4.
B.1	2	Number (m) of registration points	INTEGER*2	I6	97	102	m=4
---	---	Filler	---	---	103	144	42 spaces

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type B--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
B.2	1	A (4,3) array containing identifications and coordinates of registration points. Coordinates are expressed in the file internal reference system	ALPHA/ INTEGER*2	4(A2, 2I6)	1	56	The corners of a four-sided polygon are used as registration points. The identification sequence is SW, NW, NE, SE. The array is stored by row. Coordinates in the file internal reference system are expressed in units of thousandths of an inch and fall in the range -32768 to +32767. These coordinates correspond to the geographic coordinates contained in records A.5 and A.6.
---	---	Filler	---	---	57	144	88 spaces

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type C

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
C.1	1	Number (q) of categories in the DLG file	INTEGER*4	I6	1	6	$1 \le q \le 32$. Up to 32 categories can be represented in a given file, however, all 1:2,000,000-scale data files include only one.
---	---	Filler	---	---	7	144	138 spaces
C.2[1] to C.N	1	A (q,7) array containing category names as well as maximum and actual number of node, area, and line elements in each category	ALPHA/ INTEGER*2	q (A20,6I6)	1 (57	56 112)	This array is stored by row. The first element is the category name consisting of 20 alphanumeric characters, the first four of which are unique. Columns 2 and 3 of the array contain maximum and actual number of nodes in the category. Columns 4 and 5 contain maximum and actual number of areas in the category. Columns 6 and 7 are the maximum and actual number of line segments. (Note: the maximum number of any element type within a category is 4,770. This field is used only during initial processing of data).
---	---	Filler	---	---	---	---	32 or 88 spaces

---

[1] The number of categories "q" is given in record C.1. There will be 56 bytes of data per category, and thus a maximum of two categories can be described on a 144-character record. The space filler will vary in size depending on the value of "q."

Logical Record Type D

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
D.1	1	Type of element code	ALPHA	A2	1	2	Code ='Nb' for Node element, 'Ab' for Area element.
D.1	2	Element's internal identification number	INTEGER*2	I6	3	8	Unique within each category and element type.
D.1	3	x,y file coordinate of node point or representative point for the area element	INTEGER*2	2I6	9	20	The representative area point is usually, but not always, contained within the area it represents.
D.1	4	Number (t) of attribute codes which are attached to the node or area element ($t \geq 0$)	INTEGER*2	I6	21	26	Absence of attribute codes is indicated by t=0.
D.1	5	Number (k) of pairs of text characters which are attached to the node or area element ($k \geq 0$)	INTEGER*2	I6	27	32	k=0. Not currently used.
---	---	Filler	---	---	33	144	112 spaces
D.2	1	Code indicating a line segment graph element	ALPHA	A2	1	2	Code='Lb' for line segment
D.2	2	Line segment's internal identification number	INTEGER*2	I6	3	8	This number is unique within each category and element type.
D.2	3	Internal identification number of starting node	INTEGER*2	I6	9	14	Number refers to data element 2 in record D.1.

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type D--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
D.2	4	Internal identification number of ending node	INTEGER*2	I6	15	20	Number refers to data element 2 in record D.1.
D.2	5	Internal identification number of left area	INTEGER*2	I6	21	26	Number refers to data element 2 in record D.1.
D.2	6	Internal identification number of right area	INTEGER*2	I6	27	32	Number refers to data element 2 in record D.1.
D.2	7	Number (v) of coordinate pairs which define the line segment	INTEGER*2	I6	33	38	The value of v is between 2 and 1500.
D.2	8	Number (t) of attribute codes which are attached to the line segment ($t \geq 0$)	INTEGER*2	I6	39	44	Absence of classification attribute codes is indicated by t=0.
D.2	9	Number (k) of pairs of text characters which are attached to the line segment ($k \geq 0$)	INTEGER*2	I6	45	50	k=0. Not currently used.
	---	Filler	---	---	51	144	94 spaces

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type E

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
E.1 to[2] E.n	1	A (v,2) array containing an ordered sequence of coordinate pairs which define the image presentation of a line element	INTEGER*2	v(2I6)	1		Coordinates are expressed in internal file reference system, in units of thousandths of an inch. The array is stored by row.
---	---	Filler	---	---	---	---	0 to 132 spaces

[2] The number of coordinate pairs, "v", is given in record D.2. There will be v(2I6) coordinate pairs of which a maximum of 12 pairs will fit on a 144 character ASCII record. The space filler will vary in size depending on the value of "v." If "v" equals 12 or is an integer multiple of 12, there will be no spaces as filler at the end of the record.

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type F

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
F.1[3] to F.n	1	A (t,2) array containing major and minor attribute codes for a graph element	INTEGER* 2	t(2I6)	1		The array is stored by row with the first column containing the major attribute code and the second column containing the minor attribute code.
---	---	Filler	---	---	---	---	0 to 132 spaces

---

[3] The number of feature (attribute) codes, "t" is given in the D.1 and D.2 records. The F record is an array of t(2I6) codes of which a maximum of 12(2I6) will fit on a 144 character ASCII record. The space filler will vary depending on the value of "t". If "t" is 12 or an integer multiple of 12 there will be no spaces as filler at the end of the record.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)

In the optional DLG distribution format, topological linkages are explicitly encoded for node and area elements as well as for line elements. The files are physically comprised of 8-bit ASCII characters organized into fixed-length logical records of 80 characters (bytes). Bytes 1-72 of each record may contain DLG data, and bytes 73-80 may contain a record sequence number.

The 11 distinct record types used in the optional DLG distribution format may be categorized as header and data records.

Four types of records are considered header records:

- File identification and description records
- Accuracy records (not currently used)
- Control-point identification records
- Data-category identification records

Seven types of records are considered data records:

- Node and area identification records
- Node-to-line linkage records
- Area-to-line linkage records
- Line identification records (also contains line-to-node and line-to-area linkages)
- Coordinate string records
- Attribute code records
- Text records (not currently used)

The actual sequence of records in an optional distribution format DLG file is as follows:

1. Header records
    Ten file identification and
      description records
    Accuracy records (not currently used)
    Control point identification records
      (one per control-point)
    Data category identification records
      (one per data category in the file)

2. Data records

Node identification record Node-to-line linkage record(s) Attribute code record(s) Text record(s)	Repeated for each node within a data category	Repeated for each data category
Area identification record Area-to-line linkage record(s) Attribute code record(s) Text record(s)	Repeated for each area within a data category	
Line identification records Coordinate string record(s) Attribute code record(s) Text record(s)	Repeated for each line within a data category	

Descriptions of the contents of the various types of records in an optional distribution format DLG are contained in the following tables.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

FILE IDENTIFICATION AND DESCRIPTION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1	1	Banner	ALPHA	A72	1	72	Descriptive text
2	1	Name of digital cartographic unit	ALPHA	A40	1	40	The name of the map
---	---	Filler	---	---	41	41	1 space
2	2	Date of original source material	ALPHA	A10	42	51	Year of original source material followed by latest revision date if applicable, for example, 1956, 1965.
---		Filler	---	---	52	52	1 space
2	3	Scale of original source material	INTEGER*4	I8	53	60	Scale denominator of source material, for example, 2000000.
---		Filler	---		61	72	12 spaces
3		Filler	---	---	1	80	80 spaces

FILE IDENTIFICATION AND DESCRIPTION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
4	1	DLG level code	INTEGER*2	I6	1	6	Code=3, DLG-3
4	2	Code defining ground planimetric reference system	INTEGER*2	I6	7	12	Code=3, Albers Equal-Area Conic
4	3	Code defining zone in ground planimetric reference system	INTEGER*2	I6	13	18	Code=9999
4	4	Code defining units of measure for ground planimetric coordinates throughout the file	INTEGER*2	I6	19	24	Code=2, meters
4	5	Resolution	REAL*4	D18.11	25	42	The true ground distance corresponding to one unit (0.001 inch at map scale) in the file internal coordinate system used in data collection. For 1:2,000,000-scale 0.001 inch equals 50.8 meters.
4	6	Number of file-to-map transformation parameters	INTEGER*2	I6	43	48	Usually 4
4	7	Number of accuracy/ miscellaneous records	INTEGER*2	I6	49	54	Currently=0, none included

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

FILE IDENTIFICATION AND DESCRIPTION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
4	8	Number (n) of control-points	INTEGER*2	I6	55	60	Usually 4
4	9	Number (q) of categories in the DLG file	INTEGER*2	I6	61	66	$1 \leq q \leq 32$. Up to 32 categories can be represented in a given file; however, all 1:2,000,000-scale data files include only one.
---	---	Filler	---	---	67	72	6 spaces
5-9	1	Projection parameters for map transformation	REAL*8	3D24.15	1	72	Three parameters on each of 5 records. Parameters for the Albers Equal-Area Conic projection are given in Appendix D.
10	1	Internal file-to-map projection transformation parameters	REAL*4	4D18.11	1	72	A transformation of this type is not required, since coordinates are expressed in a ground planimetric coordinate system (Albers Equal-Area Conic). These parameters are, however, valid for transformation as described in record B.1, data element 1, of the standard format.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

CONTROL-POINT IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1-n	1	Control-point label	ALPHA	A2	1	2	"SW," "NW," "NE," or "SE" for four quadrangle corners.
		Filler			3	6	4 spaces
	2	Latitude	REAL*4	F12.6	7	18	In degrees and decimal degrees.
	3	Longitude	REAL*4	F12.6	19	30	In degrees and decimal degrees.
		Filler			31	36	6 spaces
	4	Internal file x	REAL*4	F12.2	37	48	In units in the appropriate zone of the ground planimetric coordinate system.
	5	Internal file y	REAL*4	F12.2	49	60	In units in the appropriate zone of the ground planimetric coordinate system.
---	---	Filler	---	---	61	72	12 spaces

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

DATA CATEGORY IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1-q	1	Category name	ALPHA	A20	1	20	The first 4 characters are unique.
	2	Attribute format codes	INTEGER*2	I4	21	24	Blank or zero (0) indicates default (2I6) attribute formatting in major-minor pairs.
	3	Number of nodes referenced in file	INTEGER*2	I6	25	30	Number of nodes referenced in file as start and end nodes of lines.
	4	Actual number of nodes in file	INTEGER*2	I6	31	36	Only if some or all node records were excluded from the file, would this number be different from data element 3.
		Filler	---	---	37	37	1 space
	5	Presence of node-to-area linkage records	INTEGER*2	I1	38	38	Flag=0, node-to-area linkage records not present.[1]
	6	Presence of node-to-line linkage records	INTEGER*2	I1	39	39	Flag=1, node-to-line linkage records are included.[1]
	---	Filler	---	---	40	40	1 zero or space
	7	Number of areas referenced in file	INTEGER*2	I6	41	46	Number of areas referenced in file as areas left and areas right of lines.

---

[1] The flags for lists present or absent are the current default values, and are the only current values used.

DATA CATEGORY IDENTIFICATION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1-q	8	Actual number of areas in file	INTEGER*2	I6	47	52	Only if some or all area records were excluded from the file would the number be different from the data element 7.
	---	Filler	---	---	53	53	1 space
	9	Presence of area-to-node linkage records	INTEGER*2	I1	54	54	Flag=0, area-to-node linkage records not present.[1]
	10	Presence of area-to-line linkage records	INTEGER*2	I1	55	55	Flag=1, area-to-line linkage records are included.[1]
	11	Presence of area-coordinate lists	INTEGER*2	I1	56	56	Flag=0, area-coordinate lists not present.[1]
	12	Number of lines referenced in file	INTEGER*2	I6	57	62	Number of lines referenced in area-to-line and node-to-line records.
	13	Actual number of lines in file	INTEGER*2	I6	63	68	Only if some lines were excluded from the file would this number be different from data element 12.
	---	Filler	---	---	69	71	3 spaces
	14	Presence of line-coordinate lists	INTEGER*2	I1	72	72	Flag=1, line-coordinate lists are included.[1]

---

[1] The flags for lists present or absent are the current default values, and are the only current values used.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

NODE AND AREA IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
	1	Record type	ALPHA	A1	1	1	"N" or "A"
	2	Element internal ID number	INTEGER*2	I5	2	6	This value is unique within each category and element type.
	3	Coordinates of node point or representative point for area	REAL*4	2F12.2	7	30	The area point is usually, but not always within the polygon it represents.
	4	Number of elements in an area list (for nodes), or in a node list (for areas)	INTEGER*2	I6	31	36	Blank or zero (0). These lists are not currently included.
	5	Number of elements in line segment list	INTEGER*2	I6	37	42	Number of line segments that intersect at the node, or bound the area.
	6	Number of x,y or lat-long points in area-coordinate list	INTEGER*2	I6	43	48	Blank or zero (0). These lists are not currently included.
	7	Number of attribute codes listed	INTEGER*2	I6	49	54	Number of attribute codes listed.
	8	Number of text characters listed	INTEGER*2	I6	55	60	Zero (0). There are no text attributes for 1:2,000,000-scale DLG data.
	9	Number of islands within area	INTEGER*2	I6	61	66	Area records only, 6 spaces for node records.
---	---	Filler	---	---	67	72	6 spaces

NODE-TO-LINE LINKAGE RECORDS

FORTRAN FORMAT (12I6), for each node: The list consists of line segment internal ID numbers (which appear in bytes 2-6 of the line identification records). The line segments which begin at this node are included in the list as positive ID numbers. The line segments which terminate at this node are included as negative ID numbers. There is no logical order to the list.

AREA-TO-LINE LINKAGE RECORDS

FORTRAN format (12I6), for each area: The list consists of line segment internal ID numbers (which appear in bytes 2-6 of the line identification records) and, for those areas with islands (indicated by bytes 61-66 of the area's first record), zero (0) elements marking the beginning of islands. Line segments with this area to the right are included as positive ID numbers. Line segments with this area to the left are included as negative ID numbers. The list is ordered clockwise around the perimeter of the area and counterclockwise around each island, if any (counterclockwise around an island of an area is still a clockwise direction in reference to the area itself). A zero (0) element is inserted in the list before each island sublist.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

LINE IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
	1	Record type		A1	1	1	"L"
	2	Element internal ID number		I5	2	6	This number is unique within each category and element type.
	3	Starting node		I6	7	12	Internal ID number. This refers to data element 2 of the node identification record.
	4	Ending node		I6	13	18	Internal ID number. This refers to data element 2 of the node identification record.
	5	Left area		I6	19	24	Internal ID number. This refers to data element 2 of the area identification record.
	6	Right area		I6	25	30	Internal ID number. This refers to data element 2 of the area identification record.
	---	Filler		---	31	42	12 spaces
	7	Number of x,y coordinates listed		I6	43	48	Number of coordinate pairs listed.
	8	Number of attribute codes listed		I6	49	54	Number of attributes (or two element attribute pairs) listed.
	9	Number of text characters listed		I6	55	60	Zero (0). There are no text data associated with 1:2,000,000-scale DLG data.

COORDINATE STRING RECORDS

FORTRAN format (3(2F12.2)): The coordinates are in appropriate units in the designated ground planimetric coordinate system (Albers Equal-Area Conic projection). The file-to-map projection parameters in Header record 10 are set to (1.0,0.0,0.0,0.0) for real map projection coordinates (the transformation formulas still apply).

CODE RECORDS

As major-minor attribute code pairs, FORTRAN format (6(2I6)): Within each pair, the first integer is the major code and the second integer is the minor code. Each major and minor code is a one-to-four-digit integer, right justified within the six-byte field.

APPENDIX C.--Graphic Format

The simplified, graphic format that can be used with the GS-CAM plotting package is described below. In this format, each line record from the DLG format has been reformatted into two record types: one line identifier record and multiple latitude-longitude records (one for each coordinate pair). Supplementary coordinate pairs have been added to Graphic Format data in instances where the distance between two adjacent vertices was greater than 0.01" in the original DLG line description. These additional points assure that the distance between any two data points of a line are no greater than 0.01" and minimizes distortion of the line when projection transformations are applied. If a line record has more than one attribute code associated with it in the DLG format, that line record appears in the graphic format files multiple times (once for each attribute code). The graphic format files are organized by feature type.

Record 1: Line identifier record

	Position	Length	Format
1. Line identifier	1-7	7	I7
2. Rank (last two digits of attribute code (described in Appendix E--unique within category)	8-9	2	I2
3. Number of points in the line (NP) (latitude and longitude)	10-15	6	I6
4. First five digits of attribute code (described in Appendix E)	16-20	5	I5

Record 2: Latitude-longitude record (repeated NP times)

	Position	Length	Format
1. Latitude (DDMMSSI)	1-7	7	3I2, A1
2. Longitude (DDDMMSSI)	8-15	8	I3, 2I2, A1
3. Sequence count	16-20	5	I5

APPENDIX D.--Map Projection Parameters Albers Equal-Area Conic Projection

The standard and optional DLG distribution formats include 15 fields reserved for map projection parameters. These parameters are typically used as input for a coordinate transformation package such as the USGS General Coordinate Transformation Package (GCTP).

When the ground coordinate system of a DLG is the Albers Equal-Area Conic projection, as in the case for all DLG's digitized from 1:2,000,000-scale maps, the first eight parameter fields are used:

1. Semimajor axis of ellipsoid
2. Eccentricity squared of ellipsoid
3 Latitude of first standard parallel
4. Latitude of second standard parallel
5. Longitude of central meridian
6. Latitude of projection origin
7. False easting
8. False northing
9-15. Not used

For the 1:2,000,000-scale files, the following parameters were used:

For all maps:
    Spheroid parameters: Clarke 1866
    False easting: 0.0
    False northing: 0.0

For conterminous United States:
    First standard parallel: 29.5° North
    Second standard parallel: 45.5° North
    Longitude of central meridian: 96° West
    Latitude of projection origin: 23° North

For Hawaii:
    First standard parallel: 8° North
    Second standard parallel: 18° North
    Longitude of central meridian: 157° West
    Latitude of projection origin: 3° North

For Alaska:
    First standard parallel: 55° North
    Second standard parallel: 65° North
    Longitude of central meridian: 154° West
    Latitude of projection origin: 50° North

A transformation to or from Albers Equal-Area Conic projection coordinates using GCTP can be controlled by specifying the parameters stated above. In the projection parameters of a DLG file, the longitude-latitude parameter values are encoded as packed, degrees-minutes-seconds (DMS) as follows:

degrees * 1000000 + minutes * 1000 + seconds

For example, if degrees = +50, minutes = 30, and seconds = 36.25, then the parameter value is 50030036.25 stored as a REAL*8 variable, and "bbb0.500300362500000D 08" encoded in FORTRAN D24.15 format.

APPENDIX E.--DLG Attribute Codes

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			AREA ATTRIBUTES - Available in standard and optional DLG formats (only)
Water Bodies...	040	0100	Perennial lake or pond
		0102	Intermittent lake or pond
		0104	Dry lake or pond
		0105	Alkali flat
		0106	Reservoir
		0107	Intermittent reservoir
		0110	Glacier or snowfield
		0150	Island
		0199	Area not in water body (remainder of map)
Political Boundaries	090	0100	Civil township, district, precint, or barrio
		0101	Incorporated city, village, town, borough, or hamlet
		0197	Canada
		0198	Mexico
		0199	Area outside a national boundary
Administrative Boundaries	090	0103	National park, monument, lakeshore, parkway, battlefield, or recreation area
		0104	National forest or grassland
		0105	National wildlife refuge, game preserve, or fish hatchery
		0106	National scenic waterways or wilderness area
		0107	Indian reservation
		0108	Military reservation
			PARAMETER CODES - Available in standard and optional DLG formats (only)
			Line records
Roads and Trails	102	0---	Interstate route number, two or three digits flush right
	103	0---	U.S. route number, two or three digits flush right
	104	0---	State route number, two or three digits flush right

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
Area records			
Political Boundaries	091	00--	State FIPS code, two digits flush right
	092	0---	County or county equivalent FIPS code, three digits, flush right
LINE ATTRIBUTES - available in standard and optional DLG and graphic format			
Hypsography....	290	2017	Continental Divide
Streams and Rivers	290	3001	River/stream (double line, shoreline)
		3002	River/stream (double line, centerline)
		3003*	River/stream (single line), perennial, length < 20 km, or < 12 mi
		3004	River/stream (single line), perennial, length 20-< 30 km, or 12-< 19 mi
		3005	River/stream (single line), perennial, length 30-< 40 km, or 19-< 25 mi
		3006	River/stream (single line), perennial, length 40-< 50 km, or 25-< 31 mi
		3007	River/stream (single line), perennial, length 50-< 60 km, or 31-< 37 mi
		3008	River/stream (single line), perennial, length 60-< 80 km, or 37-< 50 mi
		3009	River/stream (single line), perennial, length 80-< 100 km, or 50-< 62 mi
		3010	River/stream (single line), perennial, length 100-< 125 km, or 62-< 78 mi
	290	3011	River/stream (single line), perennial, length 125-< 150 km, or 78-< 93 mi
		3012	River/stream (single line), perennial, length 150-< 200 km, or 93-< 124 mi
		3013	River/stream (single line), perennial, length 200-< 250 km, or 124-< 155 mi
		3014	River/stream (single line), perennial, length 250-< 300 km, or 155-< 186 mi
		3015	River/stream (single line), perennial, length 300-< 350 km, or 186-< 217 mi
		3016	River/stream (single line), perennial, length 350+ km, or 217+ mi

*This code was only used in the Alaskan drainage files.

Note: Listing of FIPS codes available as National Bureau of Standards (U.S.), Federal Information Processing Standards Publication (FIPS PUB) 6-3, 39 p. for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
LINE ATTRIBUTES--continued			
Streams and Rivers (cont'd.)		3017*	River/stream (single line), intermittent, length < 20 km, or < 12 mi
		3018	River/stream (single line), intermittent, length 20-< 30 km, or 12-< 19 mi
		3019	River/stream (single line), intermittent, length 30-< 40 km, or 19-< 25 mi
		3020	River/stream (single line), intermittent, length 40-< 50 km, or 25-< 31 mi
		3021	River/stream (single line), intermittent, length 50-< 60 km, or 31-< 37 mi
		3022	River/stream (single line), intermittent, length 60-< 80 km, or 37-< 50 mi
		3023	River/stream (single line), intermittent, length 80-< 100 km, or 50-< 62 mi
		3024	River/stream (single line), intermittent, length 100-< 125 km, or 62-< 78 mi
		3025	River/stream (single line), intermittent, length 125-< 150 km, or 78-< 93 mi
		3026	River/stream (single line), intermittent, length 150-< 200 km, or 93-< 124 mi
		3027	River/stream (single line), intermittent, length 200-< 250 km, or 124-< 155 mi
		3028	River/stream (single line), intermittent, length 250-< 300 km, or 155-< 186 mi
		3029	River/stream (single line), intermittent, length 300-< 350 km, or 186-< 217 mi
		3030	River/stream (single line), intermittent, length 350+ km, or 217+ mi
		3035*	River/stream, centerline in water body, perennial, length < 2 km, or < 1 mi
		3036	River/stream, centerline in water body, perennial, length 2-< 4 km, or 1-< 2 mi
		3037	River/stream, centerline in water body, perennial, length 4-< 6 km, or 2-< 4 mi
		3038	River/stream, centerline in water body, perennial, length 6-< 8 km, or 4-< 5 mi
		3039	River/stream, centerline in water body, perennial, length 8-< 10 km, or 5-< 6 mi
		3040	River/stream, centerline in water body, perennial, length 10-< 15 km, or 6-< 9 mi
		3041	River/stream, centerline in water body, perennial, length 15-< 20 km, or 90-< 12 mi
		3042	River/stream, centerline in water body, perennial, length 20-< 25 km, or 12-< 16 mi
		3043	River/stream, centerline in water body, perennial, length 25-< 30 km, or 16-< 19 mi
		3044	River/stream, centerline in water body, perennial, length 30-< 40 km, or 19-< 25 mi
		3045	River/stream, centerline in water body, perennial, length 40-< 50 km, or 25-< 31 mi
		3046	River/stream, centerline in water body, perennial, length 50-< 60 km, or 31-< 37 mi
	290	3047	River/stream, centerline in water body, perennial, length 60-< 80 km, or 37-< 50 mi
		3048	River/stream, centerline in water body, perennial, length 80+ km, or 50+ mi
		3050	River/stream, centerline in water body, intermittent, length < 2 km, or < 1 mi
		3051	River/stream, centerline in water body, intermittent, length 2-< 4 km, or 1-< 2 mi
		3052	River/stream, centerline in water body, intermittent, length 4-< 6 km, or 2-< 4 mi
		3053	River/stream, centerline in water body, intermittent, length 5-< 8 km, or 4-< 5 mi

---

*This code was only used in the Alaskan drainage files.

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	CODE	MAJOR CODE	MINOR	DESCRIPTION
LINE ATTRIBUTES--continued				
Streams and Rivers (cont'd.)		3054		River/stream, centerline in water body, intermittent, length 8-< 10 km, or 5-< 6 mi
		3055		River/stream, centerline in water body, intermittent, length 10-< 15 km, or 6-< 9 mi
		3056		River/stream, centerline in water body, intermittent, length 15-< 20 km, or 9-< 12 mi
		3057		River/stream, centerline in water body, intermittent, length 20-< 25 km, or 12-< 16 mi
		3058		River/stream, centerline in water body, intermittent, length 25-< 30 km, or 16-< 19 mi
		3059		River/stream, centerline in water body, intermittent, length 30+ km, or 19+ mi
		3060		Braided stream, average width of braid 6+ km, or 4+ mi
		3061		Braided stream, average width of braid 0-< 2 km, or 0-< 1 mi
		3062		Braided stream, average width of braid 2-< 4 km, or 1-< 2 mi
		3063		Braided stream, average width of braid 4-< 6 km, or 2-< 4 mi
		3070*		Canal, navigable, length < 1 km, or < 1 mi
		3071		Canal, navigable, length 1-< 10 km, or 1-< 6 mi
		3072		Canal, navigable, length 10-< 20 km, or 6-< 12 mi
		3073		Canal, navigable, length 20-< 40 km, or 12-< 25 mi
		3074		Canal, navigable, length 40-< 60 km, or 25-< 37 mi
		3075		Canal, navigable, length 60-< 80 km, or 37-< 50 mi
		3076		Canal, navigable, length 80+ km, or 50+ mi
		3077		Canal, other, length < 1 km, or < 1 mi
		3078		Canal, other, length 1-< 10 km, or 1-< 6 mi
		3079		Canal, other, length 10-< 20 km, or 6-< 12 mi
		3080		Canal, other, length 20-< 40 km, or 12-< 25 mi
		3081		Canal, other, length 40-< 60 km, or 25-< 37 mi
		3082		Canal, other, length 60-< 80 km, or 37-< 50 mi
		3083		Canal, other, length 80+ km, or 50+ mi
		3086		Ditch (perennial)
		3095		Intercoastal waterway
Water Bodies...	290	4000		U.S. coastline including Great Lakes
		4001*		Perennial water body, lake, reservoir, and island, length < 2 km, or < 1 mi
		4002		Perennial water body, lake, reservoir, and island, length 2-< 4 km, or 1-< 2 mi
		4003		Perennial water body, lake, reservoir, and island, length 4-< 6 km, or 2-< 4 mi

*This code was only used in the Alaskan drainage files.

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Water Bodies (cont'd.)		4004	Perennial water body, lake, reservoir, and island, length 6-< 8 km, or 4-< 5 mi
		4005	Perennial water body, lake, reservoir, and island, length 8-< 10 km, or 5-< 6 mi
		4006	Perennial water body, lake, reservoir, and island, length 10-< 15 km, or 16-< 9 mi
		4007	Perennial water body, lake, reservoir, and island, length 15-< 20 km, or 9-< 12 mi
		4008	Perennial water body, lake, reservoir, and island, length 20-< 25 km, or 12-< 16 mi
		4009	Perennial water body, lake, reservoir, and island, length 25-< 30 km, or 16-< 19 mi
		4010	Perennial water body, lake, reservoir, and island, length 30-< 40 km, or 19-< 25 mi
		4011	Perennial water body, lake, reservoir, and island, length 40-< 50 km, or 25-< 31 mi
		4012	Perennial water body, lake, reservoir, and island, length 50-< 60 km, or 31-< 37 mi
		4013	Perennial water body, lake, reservoir, and island, length 60-< 80 km, or 37-< 50 mi
		4014	Perennial water body, lake, reservoir, and island, length 80+ km, or 50+ mi
		4021*	Intermittent water body, lake or reservoir, length < 2 km, or < 1 mi
		4022	Intermittent water body, lake or reservoir, length 2-< 4 km, or 1-< 2 mi
		4023	Intermittent water body, lake or reservoir, length 4-< 6 km, or 2-< 4 mi
		4024	Intermittent water body, lake or reservoir, length 6-< 8 km, or 4-< 5 mi
		4025	Intermittent water body, lake or reservoir, length 8-< 10 km, or 5-< 6 mi
		4026	Intermittent water body, lake or reservoir, length 10-< 15 km, or 6-< 9 mi
		4027	Intermittent water body, lake or reservoir, length 15-< 20 km, or 9-< 12 mi
		4028	Intermittent water body, lake or reservoir, length 20-< 25 km, or 12-< 16 mi
		4029	Intermittent water body, lake or reservoir, length 25-< 30 km, or 16-< 19 mi
		4030	Intermittent water body, lake or reservoir, length 30-< 40 km, or 19-< 25 mi
		4031	Intermittent water body, lake or reservoir, length 40-< 50 km, or 25-< 31 mi
		4032	Intermittent water body, lake or reservoir, length 50-< 60 km, or 31-< 37 mi
		4033	Intermittent water body, lake or reservoir, length 60-< 80 km, or 37-< 50 mi
		4034	Intermittent water body, lake or reservoir, length 80+ km, or 50+ mi
		4040*	Marsh/swamp and salt marsh, length < 10 km, or < 6 mi
		4041	Marsh/swamp and salt marsh, length 10-< 17 km, or 6-< 11 mi
		4042	Marsh/swamp and salt marsh, length 17-< 25 km, or 11-< 16 mi
	290	4043	Marsh/swamp and salt marsh, length 25-< 37 km, or 16-< 23 mi
		4044	Marsh/swamp and salt marsh, length 37-< 50 km, or 23-< 31 mi
		4045	Marsh/swamp and salt marsh, length 50+ km, or 31+ mi
		4050	Dry lake and alkali flat, length < 2 km, or < 1 mi

*This code was only used in the Alaskan drainage files.

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Water Bodies (cont'd.)		4051	Dry lake and alkali flat, length 2-< 4 km, or 1-< 2 mi
		4052	Dry lake and alkali flat, length 4-< 6 km, or 2-< 4 mi
		4053	Dry lake and alkali flat, length 6+ km, or 4+ mi
		4060*	Glacier, length < 4 km, or < 2 mi
		4061	Glacier, length 4-< 10 km, or 2-< 6 mi
		4062	Glacier, length 10-< 17 km, or 6-< 11 mi
		4063	Glacier, length 17-< 25 km, or 11-< 16 mi
		4064	Glacier, length 25-< 37 km, or 16-< 23 mi
		4065	Glacier, length 37-< 50 km, or 23-< 31 mi
		4066	Glacier, length 50+ km, or 31+ mi
Roads and Trails	290	5001	Interstate
		5002	Major U.S., limited access, divided
		5003	Major State, limited access, divided
		5004	Major other, limited access, divided
		5005	Toll road[1]
		5006	Interstate connector[1]
		5007	Limited access, divided connector[1]
		5008	Toll connector[1]
		5009	Interstate, under construction
		5010	Interstate, proposed
		5013	Minor U.S., limited access, 310 km (500 mi) and longer
		5014	U.S. non-limited access, 310 km (500 mi) and longer
		5015	Minor U.S. limited access, less than 310 km (500 mi)
	290	5016	U.S. non-limited access, less than 310 km (500 mi)
		5017	Other minor U.S. limited access
		5018	Other U.S.[2]
		5019	Other minor State primary, limited access

*This code was only used in the Alaskan drainage files.

[1] Redundant entry used to provide additional information.

[2] U.S. business, alternate, bypass, and routes paralleling U.S. or Interstate routes within 10 to 25 km.

APPENDIX E.--DLG Attribute Codes--continued

LINE ATTRIBUTES--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
Roads and Trails (cont'd.)		5020	Other State primary
		5021	Minor U.S. parallel, within 10 km (6 mi)
		5022	U.S. parallel, within 10 km (6 mi)
		5023	Minor State parallel, within 10 km (6 mi)
		5024	State parallel, within 10 km (6 mi)
		5028	State secondary (all weather, hard surface)
		5031	Light duty (all weather, improved)
		5041	Unimproved (fair or dry weather)
		5061	Tunnel, road
		5062	Ferry, auto
Railroads......	290	5071	Class 1, category A, main line
		5072	Class 1, category B, main line
		5073	Class 1, category A, branch line
		5074	Class 1, category B, branch line
		5075	Other railroad
		5078	Tunnel, railroad
		5079	Ferry, railroad
		5080	Class 1, category A, main-line connector[1]
Political Boundaries[2]	290	6000	International treaty line
		6001	National (land)
		6002	National (water)
	290	6005	State/provincial (land)
		6006	State/provincial (water)
		6009	County, parish, Alaskan borough, or large independent city (land)
		6010	County, parish, Alaskan borough, or large independent city (water)
		6011	Corporate limit (1 million and over population)
		6012	Corporate limit (1/2 to less than 1 million population)
		6014	Small independent city (usually not shown as a county)

---

[1] Redundant entry used to provide additional information.

[2] Maritime boundary areas are usually closed by unattributed arbitrary extension lines.

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Administrative Boundaries	290	6021	National park, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6022	National park, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6023	National park, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6024	National park, length at longest dimension 4-< 20 km, or 9-< 12 mi
		6025	National park, length at longest dimension 20+ km, or 12+ mi
		6026	National monument, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6027	National monument, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6028	National monument, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6029	National monument, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6030	National monument, length at longest dimension 20+ km, or 12+ mi
		6031	National seashore or lakeshore, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6032	National seashore or lakeshore, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6033	National seashore or lakeshore, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6034	National seashore or lakeshore, length at longest dimension 4-< 20 km, or 9-< 12 mi
		6035	National seashore or lakeshore, length at longest dimension 20+ km, or 12+ mi
		6036	National recreation area, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6037	National recreation area, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6038	National recreation area, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6039	National recreation area, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6040	National recreation area, length at longest dimension 20+ km, or 12+ mi
		6041	National wilderness area, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6042	National wilderness area, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6043	National wilderness area, length at longest dimension 8-< 14 km, or 5-< 9 mi
	290	6044	National wilderness area, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6045	National wilderness area, length at longest dimension 20+ km, or 12+ mi
		6051	National forest, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6052	National forest, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6053	National forest, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6054	National forest, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6055	National forest, length at longest dimension 20+ km, or 12+ mi
		6056	National grassland, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6057	National grassland, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6058	National grassland, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6059	National grassland, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6060	National grassland, length at longest dimension 20+ km, or 12+ mi

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
LINE ATTRIBUTES--continued			
Administrative Boundaries (cont'd.)		6061	National wildlife refuge, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6062	National wildlife refuge, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6063	National wildlife refuge, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6064	National wildlife refuge, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6065	National wildlife refuge, length at longest dimension 20+ km, or 12+ mi
		6066	Federal Indian reservation, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6067	Federal Indian reservation, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6068	Federal Indian reservation, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6069	Federal Indian reservation, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6070	Federal Indian reservation, length at longest dimension 20+ km, or 12+ mi
		6081	Federal Military reservation, areas of 1-< 405 ha, or 1-< 1000 acres
		6082	Federal Military reservation, areas of 405+ ha, or 1000+ acres
		6087	National park, closure line
		6088	National monument, closure line
		6089	National seashore or lakeshore, closure line
		6090	National recreation area, closure line
		6091	National wilderness area, closure line
		6092	National forest, closure line
		6093	National grassland, closure line
		6094	National wildlife refuge, closure line
	290	6095	Indian reservation, closure line
		6097	Military reservation, closure line
Cultural Features	290	7001	Commmercial airfield
		7002	Military airfield
		7020	Alaska pipeline

APPENDIX F.--Coordinate Conversion

This appendix illustrates the procedure for converting internal file coordinates to ground planimetric reference coordinates. The formulas for this conversion are as follows:

$$X=A1x+A2y+A3$$

$$Y=A1y-A2x+A4$$

where X and Y are the ground planimetric coordinate values and x and y are the internal file coordinates.

The parameters for these formulas (A1, A2, A3, and A4) are contained in Header Record B, as double-precision floating-point numbers.

This example converts four coordinate pairs from internal file coordinates to ground planimetric coordinate values (Albers Equal-Area Conic projection). The parameters are as follows:

A1= 50.325538142
A2= 6.9275199981
A3= -1185878.9723
A4= 1314164.3401

The internal file coordinates to be converted are:

	x	y
1st pair	-11238	-6583
2d pair	-10405	6583
3d pair	10405	6583
4th pair	11238	-6583

The calculation to determine the ground planimteric coordinates for the first pair are as follows:

$$X=(50.325538142)(-11238)+(6.9275199981)(-6583)+(-1185878.9723)$$
$$=-1797041.23$$

$$Y=(50.325538142)(-6583)-(6.9275199981)(-11238)+(1314164.3401)$$
$$=1060722.79$$

The resulting x,y coordinate values for the four pairs given above are as follows:

1st pair	-1,797,041.23	1,060,722.79
2d pair	-1,663,912.33	1,717,538.20
3d pair	-616,637.88	1,573,376.51
4th pair	-665,924.44	905,019.86

APPENDIX G.--Sample DLG data file (Standard Distribution Format)

```
ARIZONA AND NEW MEXICO                           1967, 1972  2000000.

     3     3  9999   0.637820640000000D+07   0.676865799729109D-02   0.2
90300000000000D+08   0.450300000000000D+08  -0.960000000000000D+08
   0.230000000000000D+08   0.0                     0.0
   0.0                     0.0                     0.0
   0.0                     0.0                     0.0
   0.0                       2   0.508000000000000D+02     0     4
  -0.115000000000000D+03   0.310000000000000D+02  -0.115000000000000D+03
   0.370000000000000D+02  -0.103000000000000D+03   0.370000000000000D+02
  -0.103000000000000D+03   0.310000000000000D+02

   0.503255381420000D+02   0.692751999810000D+01  -0.118587897230000D+07
   0.131416434010000D+07     4
SW-11238 -6583NW-10405  6583NE 10405  6583SE 11238 -6583

     1

HYPSOGRAPHY            795    18   795     2   530    13

N      1-11238 -6583     0     0

N      2-10405  6583     0     0

N      3 10405  6583     0     0

N      4 11238 -6583     0     0

N      5  1115 -3388     0     0

N      6   465 -6194     0     0

N      7  1307 -1163     0     0

N      8   932  1388     0     0

N      9  3513  4531     0     0

N     10  4036  6283     0     0

N     11     1 -6187     0     0

N     12 10635  2183     0     0

N     13  5207  6274     0     0

N     14     7  6246     0     0
```

```
N     15 -5201  6334     0     0

N     16-10031  3973     0     0

N     17-10023  -857     0     0

N     18 10402  6519     0     0

A      1   -96  5417     1     0

    0     0

A      2   287  3013     0     0

L      1     5     6     2     2   334     1     0

  1115 -3388  1102 -3399  1096 -3411  1090 -3423  1083 -3428  1075 -3434
  1067 -3444  1062 -3463  1062 -3480  1063 -3490  1062 -3497  1056 -3504
  1051 -3507  1046 -3512  1041 -3522  1038 -3530  1035 -3539  1033 -3544
  1030 -3549  1025 -3549  1017 -3549  1007 -3554   996 -3563   991 -3567
   986 -3570   982 -3572   979 -3578   977 -3585   977 -3594   976 -3600
   973 -3607   972 -3614   973 -3619   980 -3626   987 -3632   997 -3646
  1015 -3660  1035 -3674  1064 -3687  1089 -3701  1111 -3714  1142 -3730
  1191 -3767  1208 -3783  1232 -3810  1274 -3885  1279 -3913  1288 -3941
  1290 -3969  1288 -3982  1286 -4001  1287 -4015  1287 -4030  1288 -4041
  1287 -4055  1285 -4070  1285 -4085  1286 -4106  1284 -4120  1288 -4132
  1285 -4146  1283 -4162  1281 -4176  1278 -4187  1280 -4200  1285 -4223
  1291 -4231  1296 -4236  1300 -4244  1309 -4262  1325 -4283  1352 -4308
  1375 -4337  1396 -4363  1421 -4382  1450 -4410  1477 -4434  1496 -4450
  1501 -4457  1510 -4472  1513 -4483  1518 -4492  1521 -4503  1531 -4527
  1543 -4560  1550 -4595  1547 -4616  1538 -4631  1528 -4647  1510 -4658
  1494 -4666  1487 -4671  1479 -4686  1475 -4693  1469 -4705  1462 -4721
  1458 -4729  1449 -4738  1442 -4745  1429 -4751  1417 -4759  1401 -4762
  1386 -4764  1374 -4764  1360 -4765  1344 -4764  1325 -4762  1309 -4763
  1296 -4760  1286 -4759  1278 -4763  1267 -4764  1254 -4768  1231 -4780
  1206 -4790  1187 -4797  1174 -4803  1162 -4809  1149 -4816  1134 -4821
  1127 -4824  1121 -4831  1110 -4835  1098 -4839  1089 -4842  1079 -4839
  1071 -4834  1060 -4825  1055 -4817  1050 -4799  1040 -4784  1029 -4770
  1021 -4760  1006 -4744   992 -4727   972 -4710   949 -4690   939 -4678
   930 -4665   925 -4652   923 -4640   920 -4627   911 -4605   910 -4594
   903 -4578   899 -4568   891 -4561   880 -4552   870 -4545   859 -4538
   846 -4536   837 -4535   827 -4534   816 -4538   804 -4539   793 -4537
...........

290  2017

L      2     5     7     2     2   364     1     0
```

```
   1115 -3388  1124 -3380  1131 -3377  1142 -3376  1147 -3376  1150 -3374
   1157 -3369  1163 -3361  1168 -3353  1170 -3346  1172 -3336  1174 -3328
   1176 -3323  1181 -3320  1188 -3317  1198 -3312  1204 -3310  1210 -3306
   1215 -3301  1218 -3294  1217 -3283  1213 -3269  1212 -3255  1206 -3240
   1197 -3219  1194 -3204  1195 -3197  1196 -3186  1197 -3176  1204 -3166
   1211 -3152  1218 -3138  1230 -3128  1237 -3116  1244 -3101  1248 -3090
   1250 -3084  1249 -3073  1246 -3063  1239 -3045  1237 -3042  1238 -3034
   1246 -3020  1250 -3005  1251 -2994  1250 -2985  1251 -2977  1247 -2973
   1241 -2964  1231 -2960  1225 -2952  1216 -2940  1212 -2933  1208 -2928
   1195 -2910  1192 -2900  1188 -2892  1192 -2890  1201 -2890  1211 -2892
................... 1322 -1135  1316 -1140  1312 -1146  1307 -1163

    290   2017

L       3      9      8      2      2    461      1      0

   3513  4531  3504  4525  3494  4520  3488  4515  3482  4506  3473  4497
   3468  4480  3464  4470  3460  4462  3457  4451  3454  4439  3451  4432
   3446  4419  3443  4401  3436  4378  3431  4366  3426  4356  3421  4344
   3405  4336  3379  4331  3362  4326  3340  4317  3330  4309  3316  4300
   3309  4290  3303  4279  3290  4265  3285  4259  3276  4246  3266  4232
   3248  4225  3239  4222  3225  4217  3212  4215  3191  4215  3173  4218
   3155  4221  3133  4223  3124  4220  3108  4213  3093  4208  3075  4207
   3057  4208  3035  4209  3018  4210  2993  4209  2969  4206  2954  4197
.............   961  1412   951  1399   942  1393   936  1390   932  1388

    290   2017

L       4     10      9      2      2    229      1      0

   4036  6283  4028  6280  4022  6276  4012  6271  4005  6269  3995  6270
   3987  6270  3975  6274  3970  6272  3965  6267  3960  6258  3960  6252
   3962  6242  3965  6227  3961  6224  3955  6221  3947  6216  3953  6213
   3962  6207  3969  6201  3979  6193  3981  6188  3982  6180  3986  6172
   3990  6160  3993  6155  3996  6148  4004  6137  4005  6125  4006  6111
   4007  6106  4010  6098  4011  6090  4008  6089  4003  6087  3998  6084
   3990  6078  3984  6074  3980  6067  3976  6065  3970  6063  3950  6054
   3939  6047  3932  6046  3922  6035  3916  6028  3906  6015  3899  6009
................... 3513  4531

    290   2017

L       5     12      6      1      2    125      0      0

  10635  2183 10658  1872 10668  1729 10679  1579 10688  1469 10688  1379
  10682  1310 10690  1197 10702  1047 10710   888 10716   821 10720   732
  10735   533 10746   337 10764    37 10786  -390 10794  -568 10801  -786
```

```
 10810  -944 10820 -1133 10822 -1307 10828 -1399 10834 -1499 10847 -1778
 10859 -1986 10869 -2186 10877 -2330 10892 -2527 10904 -2707 10918 -2953
 10934 -3208 10944 -3383 10958 -3621 10974 -3868 10988 -4085 11002 -4334
 11005 -4403 10401 -4442  9737 -4473  9539 -4480  9366 -4489  9237 -4498
  9146 -4505  9066 -4509  8895 -4520  8761 -4530  8562 -4535  8432 -4540
  8242 -4546  8019 -4555  7920 -4556  7853 -4557  7806 -4561  7732 -4570
  7670 -4572  7607 -4575  7531 -4580  7402 -4587  7294 -4591  7151 -4598
  6944 -4608  6706 -4614  6393 -4625  6222 -4630  5917 -4644  5728 -4650
  5477 -4661  5086 -4668  4689 -4680  4431 -4683  4412 -4691  4400 -4702
  4376 -4719  4372 -4722  4370 -4733  4373 -4744  4390 -4753  4404 -4753
  4417 -4760  4414 -4786  4406 -4796  4401 -4813  4402 -4837  4403 -4856
  4404 -4865  4403 -4879  4395 -4886  4388 -4890  4384 -4894  4384 -4907
  4395 -4927  4399 -4936  4410 -4946  4418 -4964  4424 -4978  4421 -4992
  4412 -4999  4410 -5002  4421 -5019  4434 -5027  4438 -5050  4448 -5075
  4452 -5084  4455 -5088  4470 -5093  4478 -5097  4490 -5103  4500 -5108
  4506 -5113  4527 -5120  4544 -5124  4563 -5130  4569 -5133  4579 -5143
  4587 -5159  4227 -5162  3593 -5182  3138 -5195  2577 -5202  2122 -5206
  1622 -5212  1471 -5212  1473 -6186   881 -6190   465 -6194

L      6     6    11     1     2     3     0     0

   465 -6194   176 -6193     1 -6187

L      7    15    14     1     2    16     0     0

 -5201  6334 -4824  6327 -4194  6312 -3442  6299 -2851  6288 -2609  6286
 -2587  6283 -2578  6281 -2560  6276 -2544  6270 -2535  6262 -2517  6262
 -2413  6263 -1728  6251  -603  6245     7  6246

L      8    17    16     1     2   421     0     0

-10023  -857-10023  -845-10021  -828-10020  -818-10017  -805-10014  -793
-10016  -779-10021  -770-10028  -767-10032  -757-10026  -749-10015  -741
-10001  -736 -9987  -729 -9979  -727 -9969  -722 -9958  -715 -9954  -704
 -9953  -689 -9960  -680 -9966  -659 -9972  -644 -9977  -631 -9977  -616
 -9975  -603 -9969  -587 -9966  -569 -9962  -553 -9961  -538 -9965  -528
 -9968  -515 -9972  -499 -9983  -465 -9983  -445 -9983  -436 -9981  -428
 -9976  -423 -9972  -418 -9969  -411 -9969  -402 -9970  -397 -9973  -385
 -9977  -378 -9980  -367 -9980  -360 -9979  -354 -9975  -344 -9970  -333
 -9966  -326 -9958  -312 -9949  -300 -9946  -291 -9946  -284 -9947  -277
 -9948  -270 -9948  -255 -9938  -244 -9936  -243 -9934  -238 -9934  -231
 -9938  -218 -9950  -209 -9961  -201 -9970  -194 -9974  -187 -9978  -176
 .............10031  3973

L      9    16    15     1     2   158     0     0
```

APPENDIX G.--Sample DLG data file (Standard Distribution Format)--continued

```
-10031  3973-10032  3984-10034  4003-10037  4012-10038  4027-10031  4035
-10023  4038-10016  4043-10011  4048-10004  4055 -9989  4062 -9980  4063
 -9974  4075 -9978  4084 -9992  4099-10003  4107-10019  4119-10029  4134
-10033  4145-10037  4158-10044  4176-10046  4190-10049  4203-10062  4212
-10077  4231-10078  4248-10079  4262-10079  4271-10082  4287-10089  4305
-10093  4326-10095  4335-10098  4344-10097  4359-10094  4372-10085  4387
-10076  4396-10068  4401-10059  4411-10054  4418-10051  4439-10056  4449
-10058  4460-10073  4486-10073  4504-10074  4527-10068  4543-10063  4554
-10053  4565-10039  4578-10018  4591 -9998  4603 -9958  4618 -9925  4637
 -9908  4649 -9894  4659 -9881  4661 -9876  4659 -9861  4652 -9856  4646
 -9850  4642 -9842  4639 -9824  4649 -9807  4657 -9792  4668 -9768  4676
 -9742  4677 -9720  4674 -9699  4659 -9666  4640 -9631  4615 -9617  4604
 -9597  4601 -9573  4608 -9563  4610 -9547  4612 -9532  4609 -9518  4611
 -9513  4613 -9504  4620 -9494  4628 -9488  4633 -9484  4637 -9477  4642
 -9460  4646 -9436  4644 -9419  4636 -9413  4631 -9404  4622 -9398  4611
 -9394  4600 -9390  4593 -9388  4585 -9384  4578 -9373  4574 -9366  4571
 -9358  4566 -9351  4560 -9344  4540 -9335  4532 -9331  4520 -9326  4508
 -9325  4491 -9327  4474 -9328  4463 -9328  4452 -9323  4441 -9315  4433
 -9294  4409 -9271  4386 -9250  4377 -9244  4372 -9237  4367 -9228  4353
 -9218  4345 -9207  4341 -9195  4337 -9179  4337 -9164  4337 -9148  4342
 -9136  4349 -9122  4352 -9110  4358 -9095  4358 -9082  4359 -9057  4361
 -9043  4367 -9033  4377 -9022  4393 -9012  4417 -9004  4447 -9000  4465
 -9000  4484 -8990  4513 -8982  4540 -8977  4551 -8970  4564 -8961  4578
 -8954  4591 -8942  4605 -8923  4627 -8911  4645 -8905  4658 -8895  4674
 -8886  4689 -8875  4700 -8869  4708 -8864  4714 -8857  4719 -8848  4728
 -8846  4738 -8845  4762 -8827  5100 -8788  5898 -8771  6255 -8754  6485
 -7383  6418 -5201  6334

L     10    14    10     1     2    17     0     0

     7  6246   391  6245  1156  6251  1872  6258  2457  6264  2815  6269
  3629  6289  3676  6290  3684  6289  3692  6286  3700  6283  3706  6278
  3712  6273  3719  6270  3744  6271  3858  6276  4036  6283

L     11    10    12     1     2    26     0     0

  4036  6283  4303  6291  4628  6299  5063  6316  5443  6328  6150  6349
  6791  6375  7331  6399  7927  6426  8231  6439  8680  6468  9248  6502
  9900  6547 10261  6570 10406  6581 10452  5824 10479  5460 10425  5459
 10456  4873 10483  4594 10494  4465 10508  4183 10528  3917 10538  3716
 10604  2704 10635  2183

L     12    11    17     1     2   333     0     0

     1 -6187 -1739 -6193 -3872 -6160 -3919 -6144 -8111 -4445-10703 -3356
-10696 -3344-10694 -3333-10691 -3324-10687 -3315-10681 -3305-10674 -3295
-10667 -3285-10667 -3273-10674 -3267-10682 -3260-10686 -3250-10684 -3242
```

```
-10677 -3242-10669 -3240-10664 -3239-10656 -3235-10652 -3220-10651 -3206
-10653 -3194-10656 -3185-10658 -3175-10659 -3169-10658 -3158-10656 -3149
-10654 -3138-10655 -3128-10656 -3117-10658 -3108-10659 -3097-10659 -3086
-10659 -3076-10657 -3066-10651 -3057-10644 -3053-10633 -3047-10621 -3045
-10613 -3046-10604 -3039-10594 -3030-10587 -3020-10579 -3012-10567 -2993
-10554 -2971-10547 -2961-10540 -2949-10532 -2938-10526 -2928-10523 -2921
-10519 -2912-10515 -2904-10511 -2895-10504 -2885-10501 -2878-10496 -2868
............-10021  -869-10021  -863-10023  -857
L     13     7     8     2     2   408     1     0

  1307 -1163  1295 -1175  1286 -1188  1277 -1193  1265 -1194  1252 -1190
  1238 -1187  1230 -1187  1223 -1192  1211 -1198  1199 -1203  1184 -1208
  1176 -1213  1157 -1228  1136 -1243  1126 -1253  1117 -1261  1105 -1267
  1092 -1275  1085 -1277  1073 -1274  1062 -1270  1052 -1270  1039 -1272
  1022 -1279  1012 -1279   998 -1278   982 -1274   970 -1273   954 -1270
   946 -1270   932 -1268   933 -1258   935 -1248   933 -1244   921 -1233
   913 -1228   905 -1216   905 -1213   912 -1203   923 -1198   941 -1199
   957 -1203   963 -1200   970 -1196   976 -1186   982 -1180   983 -1179
   984 -1179   992 -1170  1006 -1162  1018 -1155  1042 -1145  1055 -1137
  1057 -1118  1048 -1109  1040 -1100  1033 -1093  1026 -1090  1017 -1084
.............  290  2017
```

APPENDIX H.--Sample DLG data file (Optional Distribution Format)

```
USGS-NMD  DLG DATA - CHARACTER FORMAT - 09-29-82 VERSION
ARIZONA AND NEW MEXICO                   1967, 1972  2000000.

     3     3  9999     2 0.50800000000D+02     4     0     4     1
   0.637820640000000D+07   0.676865799729109D-02   0.290300000000000D+08
   0.450300000000000D+08  -0.960000000000000D+08   0.230000000000000D+08
   0.0                     0.0                     0.0
   0.0                     0.0                     0.0
   0.0                     0.0                     0.0
 0.10000000000D+01 0.0               0.0               0.0
SW       31.000000 -115.000000       -1797041.23  1060722.79
NW       37.000000 -115.000000       -1663912.33  1717538.20
NE       37.000000 -103.000000        -616637.88  1573376.51
SE       31.000000 -103.000000        -665924.44   905019.85
HYPSOGRAPHY            0    18    18 010     2     2 010    13    13   1
N    1 -1797041.23  1060722.79           0           0     0
N    2 -1663912.33  1717538.20           0           0     0
N    3  -616637.88  1573376.51           0           0     0
N    4  -665924.44   905019.85           0           0     0
N    5 -1153236.44  1135937.23           2           0     0
     1     2
N    6 -1205386.66   999226.66           3           0     0
    -1    -5     6
N    7 -1128160.20  1246581.47           2           0     0
    -2    13
N    8 -1129360.17  1377559.74           2           0     0
    -3   -13
N    9  -977696.76  1517852.98           2           0     0
     3    -4
N   10  -939239.49  1602400.23           3           0     0
     4   -10    11
N   11 -1228689.21  1002793.31           2           0     0
    -6    12
N   12  -635544.10  1350350.81           2           0     0
     5   -11
N   13  -880370.63  1593835.17           0           0     0
N   14 -1142257.40  1628449.16           2           0     0
    -7    10
N   15 -1403743.18  1668956.33           2           0     0
     7    -9
N   16 -1663171.41  1583597.66           2           0     0
    -8     9
N   17 -1696228.73  1340469.89           2           0     0
     8   -12
N   18  -617232.22  1570176.46         -27           0     0
A    1 -1153183.85  1587442.82           8     0     1     0     0
   -12    -6    -5   -11   -10    -7    -9    -8
     0     0
```

```
A    2 -1150562.93  1463806.99           8     0     0     0     0
    12     8     9     7    10    11     5     6
L    1     5     6     2     2               334     1     0
 -1153236.44  1135937.23 -1153966.87  1135473.71 -1154351.95  1134911.37
 -1154737.04  1134349.03 -1155123.95  1134145.89 -1155568.12  1133899.36
 -1156040.00  1133451.52 -1156423.25  1132529.98 -1156541.02  1131674.44
 -1156559.97  1131164.26 -1156658.79  1130818.91 -1157009.23  1130508.19
 -1157281.64  1130391.85 -1157567.91  1130174.86 -1157888.81  1129706.25
 -1158095.21  1129324.42 -1158308.53  1128892.28 -1158443.82  1128654.50
 -1158629.44  1128423.66 -1158881.06  1128458.30 -1159283.67  1128513.72
 -1159821.56  1128331.36 -1160437.49  1127954.64 -1160716.83  1127787.97
 -1160989.24  1127671.63 -1161204.40  1127598.69 -1161396.94  1127317.52
 -1161546.08  1126979.10 -1161608.43  1126526.17 -1161700.32  1126231.14
 -1161899.79  1125899.65 -1161998.61  1125554.30 -1161982.92  1125295.74
 -1161679.13  1124894.97 -1161368.42  1124544.52 -1160962.15  1123770.69
.............-1205386.66   999226.66
   290  2017
L    2     5     7     2     2               364     1     0
 -1153236.44  1135937.23 -1152728.09  1136277.49 -1152355.02  1136379.97
 -1151794.52  1136354.10 -1151542.89  1136319.46 -1151378.06  1136399.33
 -1150991.14  1136602.46 -1150633.77  1136963.50 -1150326.72  1137331.47
 -1150177.57  1137669.89 -1150007.65  1138159.29 -1149851.58  1138548.04
 -1149716.29  1138785.81 -1149443.88  1138902.15 -1149070.82  1139004.64
 -1148532.92  1139186.99 -1148217.12  1139246.07 -1147887.45  1139405.81
 -1147601.19  1139622.80 -1147401.72  1139954.30 -1147375.84  1140514.81
 -1147480.16  1141247.07 -1147433.50  1141958.56 -1147631.54  1142755.01
 -1147938.99  1143874.19 -1147986.05  1144649.86 -1147887.24  1144995.21
 -1147760.71  1145541.86 -1147641.11  1146038.19 -1147219.55  1146492.95
 -1145050.03  1157783.39 -1145202.84  1158163.38 -1145369.50  1158442.72
 -1145899.04  1159438.64 -1145980.74  1159962.68 -1146126.62  1160392.99
 -1145911.46  1160465.93 -1145458.53  1160403.58 -1144969.13  1160233.66
 -1144495.42  1160322.29 -1143568.78  1160348.57 -1143159.25  1160343.47
 -1142900.69  1160359.16 -1142781.09  1160855.49 -1143020.70  1161349.98
 -1142951.42  1161853.24 -1142838.75  1162299.24 -1142616.66  1162422.51
 -1142243.60  1162524.99 -1141971.19  1162641.33 -1141726.49  1162556.37
.............-1128160.20  1246581.47
   290  2017
L    3     9     8     2     2               461     1     0
  -977696.76  1517852.98  -978191.26  1517613.37  -978729.15  1517431.02
  -979065.74  1517220.96  -979430.04  1516809.59  -979945.32  1516419.01
  -980314.72  1515598.11  -980585.29  1515122.57  -980842.02  1514747.67
  -981069.20  1514214.87  -981303.30  1513631.75  -981502.77  1513300.25
  -981844.46  1512680.66  -982120.13  1511795.58  -982631.74  1510686.59
  -982966.50  1510117.32  -983287.40  1509648.70  -983622.16  1509079.43
  -984482.79  1508787.67  -985825.89  1508716.16  -986716.06  1508582.30
  -987885.57  1508281.77  -988444.25  1507948.44  -989211.15  1507592.50
  -989632.71  1507137.74  -990010.86  1506625.72  -990762.08  1506011.22
```

APPENDIX H.--Sample DLG data file (Optional Distribution Format)--continued

```
   -991055.27  1505743.90  -991598.26  1505152.02  -992198.50  1504516.74
   -993152.85  1504289.15  -993626.56  1504200.52  -994365.76  1504045.88
   -995033.85  1504035.29  -996090.68  1504180.77  -996975.76  1504456.44
   -997860.84  1504732.11  -998954.14  1504985.17  -999427.86  1504896.54
  -1000281.56  1504655.10 -1001071.08  1504507.39 -1001983.87  1504581.76
  -1002882.80  1504756.78 -1003983.03  1504959.51 -1004831.64  1505127.60
.............-1129145.02  1377632.68 -1129360.17  1377559.74
   290  2017
L    4    10     9     2     2          229     1     0
   -939239.49  1602400.23  -939662.88  1602304.67  -939992.54  1602144.93
   -940530.44  1601962.58  -940896.57  1601910.42  -941392.90  1602030.02
   -941795.50  1602085.44  -942371.70  1602369.87  -942637.18  1602303.86
   -942923.45  1602086.87  -943237.42  1601668.58  -943278.99  1601366.63
   -943247.61  1600849.51  -943200.55  1600073.85  -943422.63  1599950.58
   -943745.37  1599841.17  -944182.61  1599644.96  -943901.44  1599452.42
   -943490.07  1599088.12  -943179.36  1598737.68  -942731.52  1598265.80
   -942665.51  1598000.31  -942670.61  1597590.78  -942524.72  1597160.47
   -942406.55  1596528.85  -942290.21  1596256.44  -942187.73  1595883.38
   -941861.33  1595274.38  -941894.13  1594663.54  -941940.79  1593952.06
   -941925.10  1593693.50  -941829.55  1593270.12  -941834.64  1592860.58
............. -977696.76  1517852.98
   290  2017
L    5    12     6     1     2          125     0     0
   -635544.10  1350350.81  -636541.07  1334540.24  -637028.45  1327274.41
   -637514.00  1319649.38  -637823.09  1314051.22  -638446.57  1309521.92
   -639226.52  1306091.03  -639606.73  1300348.82  -640041.95  1292716.86
   -640740.82  1284659.68  -640903.01  1281246.30  -641318.26  1276739.62
   -641941.95  1266620.92  -642746.17  1256680.92  -643918.56  1241458.56
   -645769.45  1219817.15  -646599.94  1210803.78  -647757.87  1199784.32
   -648399.48  1191770.54  -649205.53  1182189.74  -650310.27  1173419.24
   -650645.65  1168747.73  -651036.44  1163673.61  -652314.99  1149542.72
   -653152.01  1138991.88  -654034.26  1128857.50  -654629.22  1121555.20
   -655239.05  1111537.16  -655882.10  1102395.43  -656881.71  1089918.36
   -657843.02  1076974.51  -658552.08  1068098.27  -659496.28  1056023.80
   -660402.16  1043482.55  -661200.88  1032464.93  -662221.27  1019836.88
   -662548.30  1016343.64  -693215.09  1018565.16  -726846.00  1021604.95
   -736858.95  1022624.32  -745627.62  1023369.85  -752181.96  1023810.57
   -756810.08  1024088.69  -760863.83  1024441.59  -769545.70  1025072.62
   -776358.60  1025497.65  -786408.02  1026624.60  -792984.98  1027273.55
   -802588.39  1028287.82  -813873.34  1029379.73  -818862.49  1030015.23
.............-1184423.52   996546.11 -1205386.66   999226.66
L    6     6    11     1     2            3     0     0
  -1205386.66   999226.66 -1219923.81  1001279.04 -1228689.21  1002793.31
L    7    15    14     1     2           16     0     0
  -1403743.18  1668956.33 -1384818.95  1665992.38 -1353217.77  1660873.16
  -1315463.03  1655009.43 -1285796.84  1650361.68 -1273631.91  1648584.57
  -1272545.53  1648281.19 -1272106.46  1648118.19 -1271235.23  1647741.87
```

```
 -1270471.59  1647329.08 -1270074.08  1646864.12 -1269168.22  1646739.43
 -1263927.44  1646069.29 -1229537.57  1640720.03 -1172962.91  1632624.62
 -1142257.40  1628449.16
L     8    17    16     1     2               421     0     0
 -1696228.73  1340469.89 -1696145.60  1341073.79 -1695927.18  1341915.47
 -1695807.58  1342411.80 -1695566.54  1343045.25 -1695332.43  1343628.37
 -1695336.10  1344346.79 -1695525.38  1344834.35 -1695856.88  1345033.82
 -1695988.90  1345564.79 -1695631.53  1345925.83 -1695022.53  1346252.23
 -1694283.33  1346406.87 -1693530.28  1346662.17 -1693113.82  1346707.40
 -1692575.93  1346889.75 -1691973.86  1347165.82 -1691696.35  1347691.70
 -1691542.11  1348439.65 -1691832.05  1348941.07 -1691988.52  1350039.47
 -1692186.56  1350835.92 -1692348.13  1351524.79 -1692244.22  1352279.68
.............-1663171.41  1583597.66
L     9    16    15     1     2               158     0     0
 -1663171.41  1583597.66 -1663145.53  1584158.16 -1663114.56  1585128.20
 -1663203.19  1585601.92 -1663149.60  1586363.73 -1662741.90  1586717.84
 -1662318.52  1586813.40 -1661931.60  1587016.53 -1661645.33  1587233.52
 -1661244.56  1587537.31 -1660441.19  1587785.67 -1659981.33  1587773.65
 -1659596.25  1588335.99 -1659735.20  1588816.63 -1660335.84  1589668.50
 -1660834.01  1590147.31 -1661556.08  1590862.05 -1661955.43  1591686.21
 -1662080.53  1592267.50 -1662191.77  1592949.45 -1662419.35  1593903.80
 -1662423.02  1594622.21 -1662483.94  1595297.23 -1663075.82  1595840.21
 -1663699.08  1596900.31 -1663631.64  1597762.77 -1663584.98  1598474.26
 -1663522.63  1598927.19 -1663562.77  1599753.18 -1663790.35  1600707.53
 -1663846.18  1601792.08 -1663884.48  1602258.86 -1663973.11  1602732.57
.............-1512971.60  1688299.52 -1403743.18  1668956.33
L    10    14    10     1     2                17     0     0
 -1142257.40  1628449.16 -1122939.32  1625738.67 -1084398.72  1620741.07
 -1048317.14  1616133.24 -1018835.14  1612382.59 -1000783.96  1610154.17
  -959680.42  1605521.68  -957308.19  1605246.41  -956912.52  1605140.67
  -956530.69  1604934.27  -956148.87  1604727.87  -955881.56  1604434.68
  -955614.24  1604141.49  -955282.75  1603942.02  -954017.68  1603819.15
  -948245.93  1603281.05  -939239.49  1602400.23
L    11    10    12     1     2                26     0     0
  -939239.49  1602400.23  -925747.15  1600953.18  -909335.93  1599104.34
  -887326.56  1596946.41  -868119.72  1594917.85  -832394.09  1591076.93
  -799955.30  1587944.86  -772613.25  1585411.81  -742432.19  1582641.80
  -727043.17  1581190.06  -704246.10  1579539.05  -675425.66  1577315.28
  -642301.67  1575063.19  -623974.82  1573719.84  -616601.41  1573268.93
  -619530.57  1534853.84  -620693.40  1516348.30  -623417.91  1516672.06
  -625917.34  1486966.54  -626491.33  1472738.67  -626831.40  1466170.47
  -628080.40  1451881.69  -628916.61  1438356.54  -629805.79  1428171.83
  -633494.95  1376785.17  -635544.10  1350350.81
L    12    11    17     1     2               333     0     0
 -1228689.21  1002793.31 -1316297.21  1014545.24 -1423412.98  1030982.38
 -1425667.44  1032113.18 -1624862.24  1146656.44 -1747761.96  1219417.08
 -1747326.56  1219972.49 -1747149.70  1220512.22 -1746936.38  1220944.37
 -1746672.73  1221369.59 -1746301.50  1221831.28 -1745879.94  1222286.04
 -1745458.39  1222740.80 -1745375.26  1223344.71 -1745685.97  1223695.16
 -1746040.09  1224102.85 -1746172.11  1224633.82 -1746016.04  1225022.57
 -1745663.76  1224974.08 -1745247.30  1225019.31 -1744988.75  1225035.00
 -1744558.43  1225180.88 -1744253.22  1225908.05 -1744105.91  1226605.68
 -1744123.43  1227223.44 -1744212.06  1227697.15 -1744243.43  1228214.26
 -1744252.19  1228523.15 -1744125.67  1229069.80 -1743962.67  1229508.87
 -1743785.81  1230048.60 -1743766.86  1230558.78 -1743740.99  1231119.29
 -1743779.29  1231586.08 -1743753.41  1232146.58 -1743677.21  1232700.17
.........................
L    13     7     8     2     2                 408     1     0
 -1128160.20  1246581.47 -1128847.24  1246060.69 -1129390.22  1245468.81
 -1129877.79  1245279.53 -1130488.63  1245312.33 -1131115.15  1245603.69
 -1131798.92  1245851.66 -1132201.53  1245907.08 -1132588.44  1245703.94
 -1133233.91  1245485.12 -1133872.46  1245316.62 -1134661.98  1245168.91
 -1135099.22  1244972.70 -1136159.32  1244349.44 -1137320.07  1243740.03
 -1137892.60  1243306.05 -1138400.95  1242965.80 -1139046.42  1242746.97
 -1139756.07  1242434.43 -1140122.21  1242382.27 -1140705.33  1242616.38
 -1141231.20  1242893.88 -1141734.46  1242963.16 -1142402.54  1242952.56
 -1143306.57  1242718.05 -1143809.83  1242787.33 -1144507.46  1242934.64
 -1145284.95  1243246.78 -1145881.93  1243380.24 -1146666.36  1243642.05
 -1147068.96  1243697.47 -1147759.67  1243895.11 -1147640.07  1244391.44
 -1147470.14  1244880.84 -1147543.08  1245095.99 -1148070.78  1245732.71
 -1148438.75  1246039.75 -1148758.22  1246699.08 -1148737.44  1246850.06
...............
   290  2017
```

APPENDIX I.--Data Sources and Currency

The published 1:2,000,000-scale National Atlas sectional maps were completely revised in 1972-73. Selected information from these maps was revised before digitizing. The source and date of the updated information are presented below:

Category	Source	Currency of Data
Political Boundaries, Alaskan borough boundaries	Bureau of the Census	1979
Administrative Boundaries	Administering Federal agency	Various
Roads and Trails	Various	1980
Railroads	Interstate Commerce Commission	1979
Streams, Alaska	Landsat imagery	1979
Water Bodies, major reservoirs	National Oceanic and Atmospheric Administration Sectional Aeronautical Charts	1979-80
Cultural Features, airports	Federal Aviation Administration	1980
Alaska pipeline	USGS maps	1979

National Mapping Program
Technical Instructions
Data Users Guide 5

US GeoData

Digital Elevation Models

Data Users Guide

Department of the Interior
U. S. Geological Survey

DATA USERS GUIDES

1: Digital Line Graphs from 1:24,000-Scale Maps
2: Digital Line Graphs from 1:100,000-Scale Maps
3: Digital Line Graphs from 1:2,000,000-Scale Maps
4: Land Use and Land Cover from 1:250,000- and 1:100,000-Scale Maps
5: Digital Elevation Models
6: Geographic Names Information System
7: Alaska Interim Land Cover Mapping Program

Data Users Guides 1-7 generally replace the Geological Survey Circular 895.

Questions regarding availability and ordering of US GeoData (all types of digital cartographic and geographic data produced and distributed by the U.S. Geological Survey) should be addressed to:

User Services Branch
Earth Science Information Center
U.S. Geological Survey
507 National Center
Reston, Virginia 22092
(703) 860-6065

Technical questions and comments should be addressed to:

Office of Technical Management
U.S. Geological Survey
510 National Center
Reston, Virginia 22092

UNITED STATES
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

DIGITAL ELEVATION MODELS

Data Users Guide 5

Reston, Virginia
1990

First printing, 1987
Second printing (revised), 1990

CONTENTS

Page

Introduction 1
7.5-minute Digital Elevation Models 2
  Characteristics 2
Data production 3
1-degree Digital Elevation Models 5
  Characteristics 5
  Data production 6
30-minute Digital Elevation Models 7
  Characteristics 7
  Data production 7
15-minute Alaska Digital Elevation Models 8
  Characteristics 8
  Data production 8
7.5-minute Alaska Digital Elevation Models 9
  Characteristics 9
  Data production 9
Geometry 10
Accuracy 10
Classification levels 14
  Level 1 14
  Level 2 14
  Level 3 14
Digital Elevation Model caveats 15
Data records 15
  Sample data records 16
Sample applications 16
Appendix A. Digital Elevation Model data elements--logical record type A 29
Appendix B. Digital Elevation Model data elements--logical record type B 35
Appendix C. Digital Elevation Model data elements--logical record type C 37
Appendix D. Sample quadrilateral coordinates 38
Appendix E. Codes for State plane coordinate zones 39
Appendix F. Universal Transverse Mercator zone locations and central meridians 41
Appendix G. Parameters required for definition of map projections 42
Appendix H. National and international datums used for digital elevation data 47

ILLUSTRATIONS

Page

Figure 1. Structure of a 7.5-minute Digital Elevation Model, UTM meter grid 4
2. Structure of a 1-degree Digital Elevation Model, arc-second grid 6
3. Computation of a first data point in a 7.5-minute Digital Elevation Model west of the central meridian 11
4. Computation of first data point in a 7.5-minute Digital Elevation Models east of the central meridian 12
5. Geometry and nomenclature of the Digital Elevation Models file 13
6. Preeruption isometric plot of Mount St. Helens Digital Elevation Models 25
7. Posteruption isometric plot of Mount St. Helens Digital Elevation Models 25

TABLES

Page

Table 1. Sample Digital Elevation Model type A logical records--Mannboro, Virginia, quadrangle (7.5 minute) 17
2. Sample Digital Elevation Model type B logical records--Mannboro, Virginia, quadrangle (7.5 minute) 20
3. Sample Digital Elevation Model type C logical records--Mannboro, Virginia, quadrangle (7.5 minute) 21
4. Sample Digital Elevation Model type A logical records--Reno, Nevada-California,quadrangle (west half) (1 degree) 22
5. Sample Digital Elevation Model type B logical records--Reno, Nevada-California, quadrangle (west half) (1 degree) 24

DIGITAL ELEVATION MODELS

INTRODUCTION

The Earth Science Information Center (ESIC) distributes digital cartographic/geographic data files produced by the U.S. Geological Survey (USGS) as part of the National Mapping Program. Digital cartographic data files may be grouped into four basic types. The first of these, called a Digital Line Graph (DLG), is the line map information in digital form. These data files include information on planimetric base categories, such as transportation, hydrography, and boundaries. The second type, called a Digital Elevation Model (DEM), consists of a sampled array of elevations for a number of ground positions at regularly spaced intervals. The third type is Land Use and Land Cover digital data which provides information on nine major classes of land use such as urban, agricultural, or forest as well as associated map data such as political units and Federal land ownership. The fourth type, the Geographic Names Information System, provides primary information for all known places, features, and areas in the United States identified by a proper name.

The digital cartographic data files from selected quadrangles currently available from ESIC include the following:

- Digital Line Graphs (DLG's)
  - 1:24,000-scale
  - 1:62,500-scale
  - 1:63,360-scale
  - 1:100,000-scale
  - 1:2,000,000-scale

- Digital Elevation Models (DEM's)
  - 7.5-minute
  - 15-minute
  - 30-minute
  - 1-degree

- Land Use and Land Cover digital data
  - 1:250,000- and 1:100,000-scale land use and land cover and associated maps
  - 1:250,000-scale Alaska Interim Land Cover Maps

- Geographic Names

The digital data are useful for the production of cartographic products such as plotting base maps and for various kinds of spatial analysis. A major use of these digital cartographic/geographic data is to combine them with other geographically referenced data, enabling scientists to conduct automated analyses in support of various decision making processes.

Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government. Manuscript approved for publication August 3, 1990.

This document describes five distinct digital elevation products that are distributed by the USGS in the standard DEM format:

1. 7.5-Minute DEM (30- x 30-m data spacing, cast on Universal Transverse Mercator (UTM) projection). Provides coverage in 7.5- x 7.5-minute blocks. Each product provides the same coverage as a standard USGS 7.5-minute map series quadrangle.

2. 1-Degree DEM (3- x 3-arc-second data spacing). Provides coverage in 1- x 1-degree blocks. Two products (three in some regions of Alaska) provide the same coverage as a standard USGS 1- x 2-degree map series quadrangle. The basic elevation model is produced by or for the Defense Mapping Agency (DMA), but is distributed by USGS in the DEM data record format.

3. 30-Minute DEM (2- x 2-arc-second data spacing). Consists of four 15- x 15-minute DEM blocks. Two 30-minute DEM's provide the same coverage as a standard USGS 30- x 60-minute map series quadrangle. Saleable units will be 30- x 30-minute blocks, that is, four 15- x 15-minute DEM's representing one half of a 1:100,000-scale map.

4. 15-minute Alaska DEM (2- x 3-arc-second data spacing, latitude by longitude). Provides coverage similar to a 15-minute DEM, except that the longitudinal cell limits vary from 20 minutes at the southernmost latitude of Alaska to 36 minutes at the northernmost latitude limits of Alaska. Coverage of one DEM will generally correspond to a 1:63,360-scale quadrangle.

5. 7.5-minute Alaska DEM (1- x 2-arc-second data spacing, latitude by longitude). Provides coverage similar to a 7.5-minute DEM, except that the longitudinal cell limits vary from 10 minutes at the southernmost latitude of Alaska to 18-minutes at the northernmost latitude limits of Alaska.

The UTM-based DEM's (7.5-minute DEM) and the geographic-based DEM's (30-minute, Alaska, and 1-degree DEM's) are identical in logical data structure but differ in sampling interval, geographic reference system, areas covered, and horizontal and vertical accuracy. Knowledge of all of these properties is essential to ensure that the user does not exceed the useful limits of the data for required applications. The 7.5-minute UTM DEM's are available for selected quadrangles, which are indicated on a status graphic published biannually by USGS. The 1-degree DEM's are available for all of the contiguous United States, Hawaii, and portions of Alaska, Puerto Rico, and the Virgin Islands. Many of the original 1-degree DEM's are being replaced with more accurate digital models through a cooperative regridding project with DMA, scheduled for completion in 1995. As they become available, these 1-degree DEM's will replace their corresponding product. The 30-minute and Alaska DEM's are new DEM series and are available on a limited basis as projects are completed.

7.5-MINUTE DIGITAL ELEVATION MODELS

Characteristics

A 7.5-minute DEM has the following characteristics:

- The data consist of a regular array of elevations referenced horizontally in the UTM coordinate system. The reference datum may be North American Datum of 1927

(NAD 27), North American Datum of 1983 (NAD 83), Old Hawaiian Datum (OHD), or Puerto Rico Datum of 1940 (PRD).

- The unit of coverage is the 7.5-minute quadrangle. Overedge coverage is not provided.
- The data are ordered from south to north in profiles that are ordered from west to east.
- The data are stored as profiles in which the spacing of the elevations along and between each profile is 30 m.
- The profiles do not always have the same number of elevations because of the variable angle between the quadrangle's true north and the grid north of the UTM coordinate system.
- Elevations for the continental U.S. are either meters or feet referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Elevations for Hawaii and Puerto Rico are either in meters or feet referenced to local mean sea level. DEM's of low-relief terrain or generated from contour maps with intervals of 10 ft (3 m) or less are generally recorded in feet. DEM's of moderate to high-relief terrain or generated from maps with terrain contour intervals greater than 10 ft are generally recorded in meters.

Profiles for 7.5-minute DEM's are generated by using a UTM cartesian coordinate system as a base. The profiles are clipped to the straight-line intercept between the four geographic corners of the quadrangle--an approximation of the geographic map boundary (neatline) as shown in figure 1. The resulting area of coverage for the DEM is a quadrilateral, the opposite sides of which are not parallel. (See appendix D for an example of UTM coordinates describing a 7.5-minute quadrilateral figure.)

The UTM coordinates of the four corners (bounds) of the DEM's are listed in the type A record, as shown in table 1, data element 11; the UTM coordinates of the starting points of each profile are listed in the type B record (profiles), table 2, data element 3. These coordinates describe the shape of the quadrilateral and the variable x, y starting position of each profile. Because of the variable orientation of the quadrilateral in relation to the UTM coordinate system, profiles intersect the east and west neatlines as well as the north and south neatlines as shown in figure 1. In addition, DEM's have profile easting values that are continuous from one DEM to the adjoining DEM only if the adjoining DEM is contained within the same UTM zone.

Data Production

The 7.5-minute DEM data are produced in 7.5- x 7.5-minute blocks either from map contour overlays that have been digitized, or from automated or manual scanning of National Aerial Photography Program quad-centered photographs. Manual scan data produced before 1988 was from the National High-Altitude Photography Program. These files are still available from archive. The data are processed to produce a DEM having a 30-m sampling interval. The structure of a 7.5-minute DEM data file is shown in figure 1. (See tables for sample data records.)

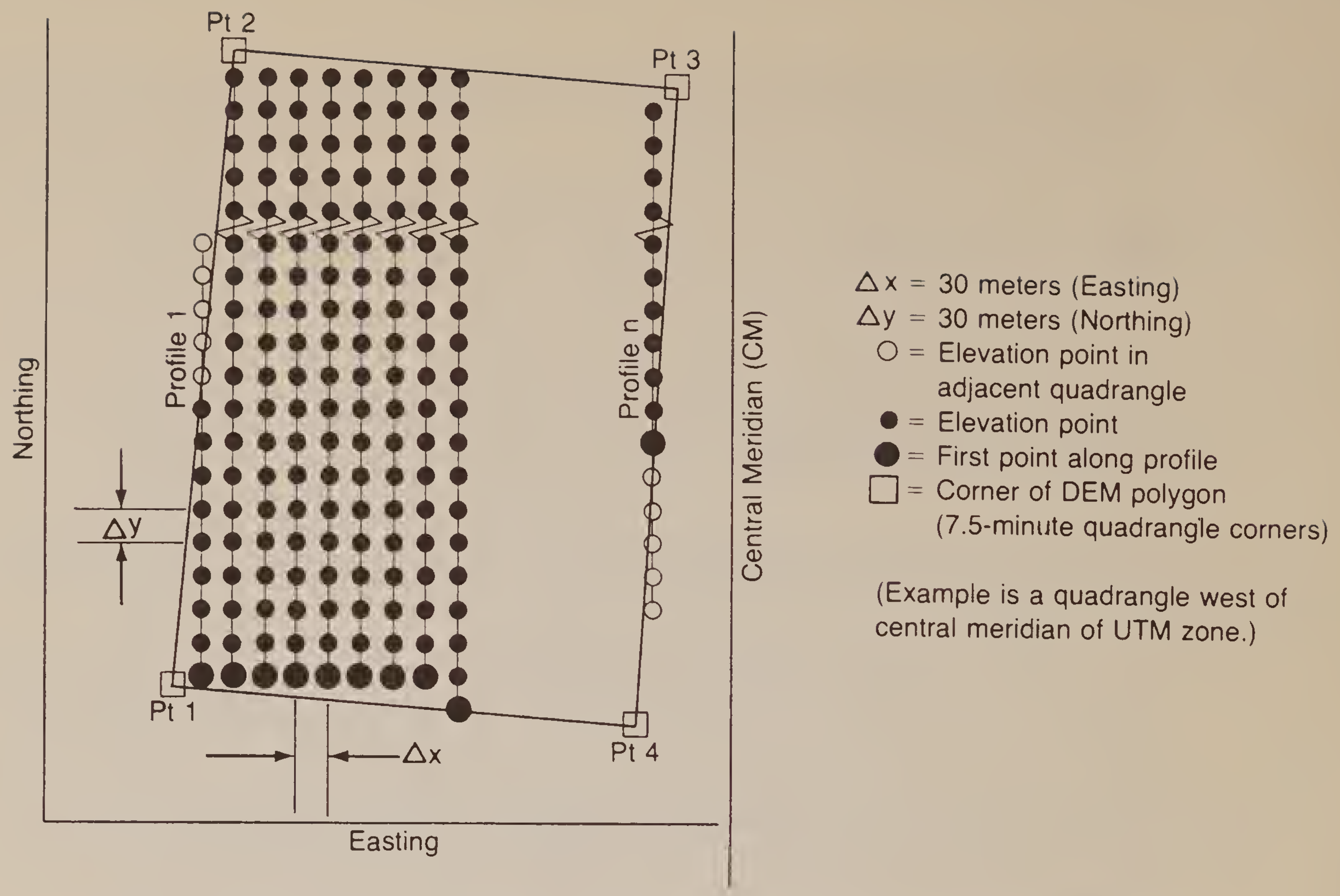

Pt 2
Pt 3
Northing
Profile 1
Profile n
Central Meridian (CM)
Δy
Pt 1
Δx
Pt 4
Easting
Δx = 30 meters (Easting)
Δy = 30 meters (Northing)
○ = Elevation point in adjacent quadrangle
• = Elevation point
● = First point along profile
☐ = Corner of DEM polygon (7.5-minute quadrangle corners)
(Example is a quadrangle west of central meridian of UTM zone.)

Figure 1.--Structure of a 7.5-minute Digital Elevation Model, UTM meter grid.

The USGS has used four processes to collect the digital elevation data for production of 7.5-minute DEM's: (1) the Gestalt Photo Mapper II (GPM2), (2) manual profiling from photogrammetric stereomodels, (3) stereomodel digitizing of contours, and (4) derivation from DLG hypsography and hydrography categories.

The GPM2 is an automated photogrammetric system designed to produce orthophotographs, digital terrain data, and contours. An electronic image correlation component of the GPM2 measures the parallax of 2,444 points within each 9- x 8-mm area of a photogrammetric stereomodel. Of these 2,444 correlated points, subunits of 576, 1,024, or 1,600 points are collected for inclusion in the elevation model. These subunits are called patches, and the patch size is selected to accommodate various terrain conditions. The horizontal (x and y) spacing of the elevation points within each patch is approximately 182 mm at photographic scale (equivalent to a ground distance of approximately 47 ft when using photographs at 1:80,000 scale). Each of the two National Aerial Photography Program stereomodels used to cover a standard 7.5-minute quadrangle contains over 500,000 correlated points; these are regridded to form a DEM in the standard format.

The manual profiling process uses stereoplotters, equipped with three-axis electronic digital profile recording modules, for scanning of stereomodels along successive terrain profiles. High-altitude aerial photographs are used as source material. The scan speed and distance between profiles are selected by the operator to accommodate steepness in topographic slope. The most commonly used profile separation is approximately 90-m, with elevations normally recorded every 30 m along each profile. The profiled elevation data are reformatted and regridded using a weighted four-nearest-neighbor interpolation to a regular 30-m UTM spacing, written in standard DEM format, and tested for vertical accuracy before placement in the National Digital Cartographic Data Base. Digital profile data of this type are collected as companion products during the production of orthophotographs.

For the digital data production process, digital contours are acquired in digital form on stereoplotters equipped with three-axis digital recording modules. Digital data are acquired as the contours are stereocompiled for 7.5-minute quadrangle maps. The contours are assigned elevation values (attributes) during the acquisition phase. The contour data are processed into profile lines, and the elevation matrix is computed at a 30-m spacing using a bilinear interpolation.

Derivation of DEM's from DLG's is a process that involves the use of hardware such as scanners, manual digitizers, and (or) semiautomated line followers. The hypsography and hydrography categories of DLG data are required as input to DEM processing. Contours and spot elevations in three-dimensional coordinates are required from the hypsographic category. Lake and shoreline data are required from the hydrographic category for water body flattening. Drainage data are also extracted from the hydrography file. Elevations are computed where contours merge with the hydrographic data. Ridge-line control point files are normally used only to satisfy specified requirements. In all other instances ridgelines are interpolated automatically by computer programs. The various coordinate arrays are input to contour-to-grid software to interpolate gridded elevations for the DEM. A subsequent processing step involves trimming the grid along the quadrangle perimeter and formatting the data into a DEM file structure. The DEM is finally processed by the DEM Editing System to validate and test the accuracy before entry into the National Digital Cartographic Data Base.

1-DEGREE DIGITAL ELEVATION MODELS

Characteristics

A 1-degree DEM has the following characteristics:

- The product consists of a regular array of elevations referenced horizontally on the geographic (latitude/longitude) coordinate system of the World Geodetic System 1972 Datum (WGS 72) or the World Geodetic System of 1984 (WGS 84).

- The unit of coverage is a 1- x 1-degree block. Elevation data on the integer degree lines (all four sides) correspond with the same profiles on the surrounding eight blocks.

- Elevations are in meters relative to NGVD 29 in the continental U.S. and local mean sea level in Hawaii and Puerto Rico.

- The data are ordered from south to north in profiles that are ordered from west to east.

- Spacing of the elevations along each profile is 3 arc-seconds. The first and last data points are at the integer degrees of latitude. A profile will therefore contain 1,201 elevations.

- Spacing between profiles varies by latitude; however, the first and last data points are at the integer degrees of longitude. North of 50° degrees N and south of 70° N, the spacing is 6 arc-seconds with 601 profiles per product. For the remainder of Alaska north of 70° N the spacing is 9 arc-seconds with 401 profiles per product.

Data Production

The majority of the 1-degree Digital Elevation Models are produced by DMA from cartographic and photographic sources. Under a cooperative agreement, selected 1-degree DEM's are being regridded by USGS from 7.5-minute DEM's and 30-minute DEM's. These data sets will be available upon completion of quality control and exchange between DMA and USGS.

Elevation data from cartographic sources are collected from any map series 7.5 minute through 1 degree (1:24,000 scale through 1:250,000 scale). The hypsographic features (contours, drain lines, ridge lines, lakes, and spot elevations) are first digitized and then processed into the required matrix form and interval spacing. The structure of a 1-degree DEM data file is shown in figure 2 (see tables for sample data records).

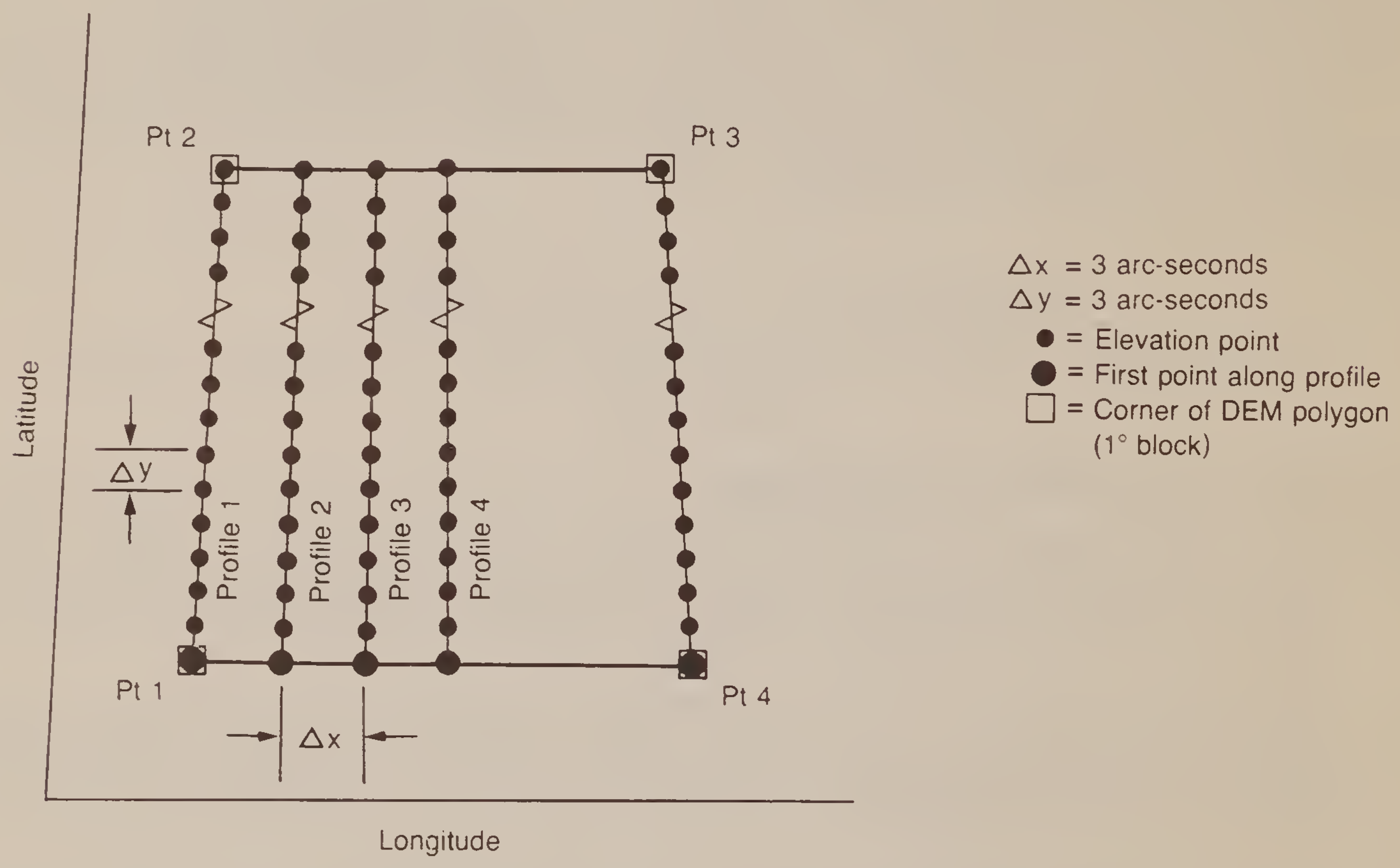


Figure 2.--Structure of a 1-degree Digital Elevation Model, arc-second grid.

Elevation data from photographic sources are collected by using manual and automated correlation techniques. Elevations along a profile are collected at 80 to 100 percent of the eventual point spacing. The raw elevations are weighted with additional information such as drain, ridge, water, and spot heights during the resampling process in which final elevations are determined for the required matrix form and interval spacing.

The digital elevation models distributed within the Department of Defense cover 1- x 1-degree blocks but are called Digital Terrain Elevation Data Level 1 (DTED-1). These blocks are referenced by their southwest corner coordinates rather than by the name of a corresponding map sheet. The header records and profile records are considerably different in their structure than those in the corresponding USGS-distributed version; however, in reformatting the product, the USGS does not change the basic elevation information.

The accuracy of the DMA product, together with the data spacing, adequately support computer applications that analyze hypsographic features to a level of detail similar to manual interpretations of information as printed at map scales not larger than 1:250,000. The plotting of contours from the 1-degree DEM at scales larger than 1:250,000, or reliance on the elevation heights without incorporating the National Map Accuracy Standard (NMAS) horizontal error tolerance, will lead to less reliable results.

Note that DMA 1-degree DTED-l data and USGS-distributed 1-degree DEM's are gridded by using the WGS 72 or WGS 84 datum, which is significantly different than the NAD 27 datum used by the USGS for gridding 7.5-minute DEM's. At the present time, policy issues concerning the transformation algorithms and procedures to convert to or from NAD 27 and WGS 72 to WGS 84 and (or) NAD 83 are being developed. See appendix H for additional information related to these datums. Also refer to "North American Datum of 1983 Map Data Conversion Tables," U.S. Geological Survey Bulletin 1875 A, B and C.

30-MINUTE DIGITAL ELEVATION MODELS

Characteristics

A 30-minute DEM has the following characteristics:

- The product consists of a regular array of elevations referenced horizontally to the geographic (latitude/longitude) coordinate system of NAD 27 or NAD 83.
- The unit of coverage is a 30- x 30-minute block. Saleable units are four 15-minute DEM's covering a 30- x 30-minute area. Elevation data on the integer minute lines (all four sides) correspond to the same profiles on the surrounding eight blocks.
- Elevations are in meters or feet relative to NGVD 29 in the continental U.S. and local mean sea level in Hawaii and Puerto Rico.
- The data are ordered from south to north in profiles that are ordered from west to east.
- Spacing of the elevations along each profile is 2 arc-seconds. The first and last data points are at the integer 15 minutes of latitude. A 15-minute profile will therefore contain 451 elevations.

Data Production

The USGS uses two processes to collect the digital elevation data for production of 30-minute DEM's: (1) derivation from DLG contours of any map series 7.5 minute to 30 x 60 minute (1:24,000 scale to 1:100,000 scale), (2) resampling from digital elevation models with a source spacing equal to or less than 2-arc second sampling interval (archived as level 1). DEM data for this series are produced according to level 2 (see Level 2, p. 14) accuracy specifications.

The accuracy of the DEM data, together with the data spacing, adequately support computer applications that analyze hypsographic features to a level of detail similar to manual interpretations of information as printed at map scales not larger than 1:100,000. The plotting of contours from 30-minute DEM data at scales larger than 1:100,000, or reliance on the elevation heights without incorporating the NMAS horizontal error tolerance, will lead to less reliable results.

15-MINUTE ALASKA DIGITAL ELEVATION MODELS

Characteristics

15-minute Alaska DEM's have the following characteristics:

- The product consists of a regular array of elevations referenced horizontally on to the geographic (latitude/longitude) coordinate system of NAD 27 or NAD 83.

- The unit of coverage corresponds to four basic quadrangle sizes for 1:63,360-scale graphics (depending on latitude):

Cell size limits

15 x 36 minutes	State of Alaska north of 68° N latitude
15 x 30 minutes	Between 62° N and 68° N latitude
15 x 22.5 minutes	Between 59° N and 62° N latitude
15 x 20 minutes	State of Alaska south of 59° N latitude

- The longitudinal limits of these cells are computed east and west of the -150 degree meridian. The north-south cell limits conform to even multiples of 15 minutes of latitude.

- The data are collected with a 2- x 3-arc-second spacing in latitude, and longitude, respectively. The first and last data points along a profile are at the integer degrees of latitude. A profile will therefore contain 451 elevations.

- Elevation data on the quadrangle neatlines (all four sides) share edge profiles with the surrounding eight quadrangles.

- Elevations are in meters or feet relative to NGVD 29.

- The data are ordered from south to north in profiles that are ordered from west to east.

Data Production

The 15-minute Alaska DEM data are produced to match the spatial format of the 1:63,360-scale source contours. The primary process used for production of Alaska DEM's is to combine digitized hypsographic and hydrographic data from 1:63,360-scale graphics. Processing can include all of the scanning, resampling, and contour interpolation programs previously mentioned. Data production for this series is according to level 2 specifications or better.

The accuracy of the DEM data, together with the data spacing, adequately support computer applications that analyze hypsographic features to a level of detail similar to manual interpretations of information as printed at map scales not larger than 1:63,360. The plotting of contours from the 15-minute Alaska DEM's at scales larger than 1:63,360, or reliance on the elevation heights without incorporating the NMAS horizontal error tolerance, will lead to less reliable results. DEM data for this series are produced according to level 2 accuracy specifications.

7.5-MINUTE ALASKA DIGITAL ELEVATION MODELS

Characteristics

7.5-minute Alaska DEM's have the following characteristics:

- The product consists of a regular array of elevations referenced horizontally to the geographic (latitude/longitude) coordinate system of NAD 27 or NAD 83.

- The unit of coverage corresponds to four basic quadrangle sizes for 1:24,000- and 1:25,000-scale graphics (depending on latitude):

Cell size limits	
7.5 x 18 minutes	State of Alaska north of 68° N latitude
7.5 x 15 minutes	Between 62° N and 68° N latitude
7.5 x 11.25 minutes	Between 59° N and 62° N latitude
7.5 x 10 minutes	State of Alaska south of 59° N latitude

- The longitudinal limits of these cells are computed east and west of the -150 degree meridian. The north-south cell limits conform to even multiples of 7.5 minutes of latitude.

- The data are collected with a 1- x 2-arc-second spacing in latitude and longitude, respectively. The first and last data points along a profile are at the integer degrees of latitude. A profile will therefore contain 451 elevations.

- Elevation data on the quadrangle neatlines (all four sides) share edge profiles with the surrounding eight quadrangles.

- Elevations are in meters or feet relative to NGVD 29.

- The data are ordered from south to north in profiles that are ordered from west to east.

Data Production

The 7.5-minute Alaska DEM data are produced to match the spatial format of the 1:24,000- and 1:25,000-scale source contours. The collection of elevation data is primarily by digitizing map separates at scale. DEM data for this series are produced according to level 2 accuracy specifications.

The accuracy of the DEM data, together with the data spacing, adequately support computer applications that analyze hypsographic features to a level of detail similar to manual interpretations of information as printed at map scales not larger than 1:24,000. The plotting of the contours from the Alaska DEM's at scales larger than 1:24,000, or reliance on the elevation heights without incorporating the NMAS horizontal error tolerance will lead to less reliable results.

GEOMETRY

Profiles are the basic building blocks of DEM's and are defined as one-dimensional arrays, that is, arrays of dimension in m rows x n columns, where m is the length of the profile (variable length for 7.5-minute DEM's or fixed length for 30-minute, Alaska, and 1-degree DEM's) and n is set to 1.

Figure 3 provides an example of the computation for the first data point inside the quadrilateral representing a 7.5-minute DEM west of the UTM central meridian. Figure 4 provides a similar example for a quadrangle east of the central meridian.

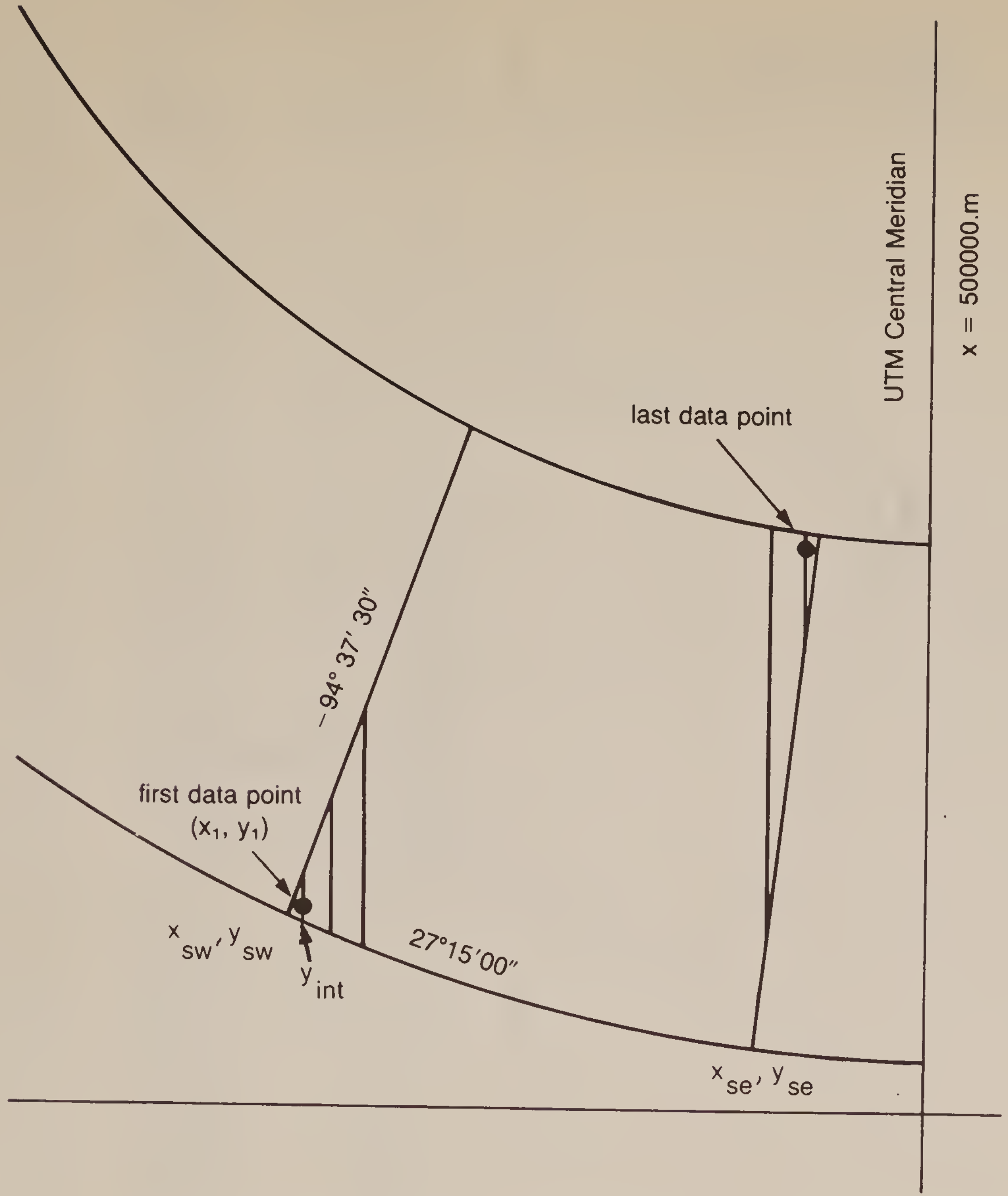
Figure 5, formula 1, illustrates the internal horizontal relationship (x_p, y_p) of elevations ordered as profiles in which the spacing of the elevations along each profile is Δy and the spacing between profiles is Δx. Figure 5, formula 2, relates the internal array structure to actual ground coordinates (x_{gp}, y_{gp}) based on an origin of the DEM at the lower left corner (x_{go}, y_{go}), and a rotation angle measured from quadrangle north, if any. The rotation angle of 7.5-minute DEM's is normally set to zero (see record A, element 13 in table 1). The rotation angle for a 1-degree DEM is always set to zero (see record A, element 13, in table 4). In general the mathematics is simpler for a 1-degree DEM. Each 1-degree DEM profile is composed of the same number of elevations per profile and the array is a square or rectangle. Therefore, the equations of figure 5 are greatly simplified.

ACCURACY

The accuracy of a DEM is dependent upon its source and the spatial resolution, that is, grid spacing, of the data samples. One factor influencing DEM accuracy is source data scale and resolution. A dependency exists between the scale of the source materials and the level of grid refinement possible. The source resolution is also a factor in determining the level of content that may be extracted during digitization. For example, 1:250,000-scale topographic maps are the primary source of 1-degree DEM's. Larger scale maps, such as 1:100,000 and 1:24,000, are used to generate higher accuracy DEM's. Scales smaller than 1:250,000 have not been used as a DEM source.

Another factor is the horizontal and vertical dimension of the DEM. Horizontal accuracy of DEM data is dependant upon the horizontal spacing of the elevation matrix. Within a standard DEM, most terrain features are generalized by being reduced to grid nodes spaced at regular intersections in the horizontal plane (7.5-minute DEM interval is 30 m; 1-degree DEM interval is 3 arc-seconds). This generalization reduces the ability to recover positions of specific features less than the internal spacing during testing and results in a de facto filtering or smoothing of the surface during gridding.

Vertical accuracy of DEM data is dependant upon the spatial resolution (horizontal grid spacing), quality of the source data, collection and processing procedures, and digitizing systems. As with horizontal accuracy, the entire process, beginning with project authorization, compilation of the source data sets, and the final gridding process, must satisfy accuracy criteria customarily applied to each system. Each source data set must qualify to be used in the next step of the process. Errors have the effect of compounding for each step of the process. For this reason, production personnel are directed to account for each production step leading to the final DEM.



Example computation of UTM coordinates (x_1,y_1) of the first data point in a 7.5-minute DEM west of the central meridian.

The southwest corner of the 7.5-minute DEM in this example is at latitude 27°15'00", longitude -94°37'30" (x_{sw} = 339117.761, y_{sw} = 3015001.964). The southeast corner is at latitude 27° 15'00". longitude -94° 30'00" (x_{se} = 351495.041, y_{se} = 3014847.375).

Compute x coordinate (x_1) of the first profile. The first profile is offset to the next integer multiple of 30 m east of the southwest corner.

$\frac{x_{sw}}{30m} = \frac{339117.761m}{30m}$
= 11303.9 (round up)
= 11304
x_1 = 11304 (30m)

= 339120m

Compute y coordinate (y_1) of the first data point on the first profile. The first data point is offset to the next integer multiple of 30 m north of the intercept (y_{int}) of the first profile with the southern latitude line of the 7.5-minute quadrangle.

a) Use the slope intercept formula y = mx + b to compute y_{int}.

$m = (y_{se} - y_{sw}) / (x_{se} - x_{sw})$
= -154.589/12377.280
= -.0124897

$b = y_{sw} - mx_{sw}$
= 3015001.964 -(-.0124897)(339117.761)
= 3019237.443m

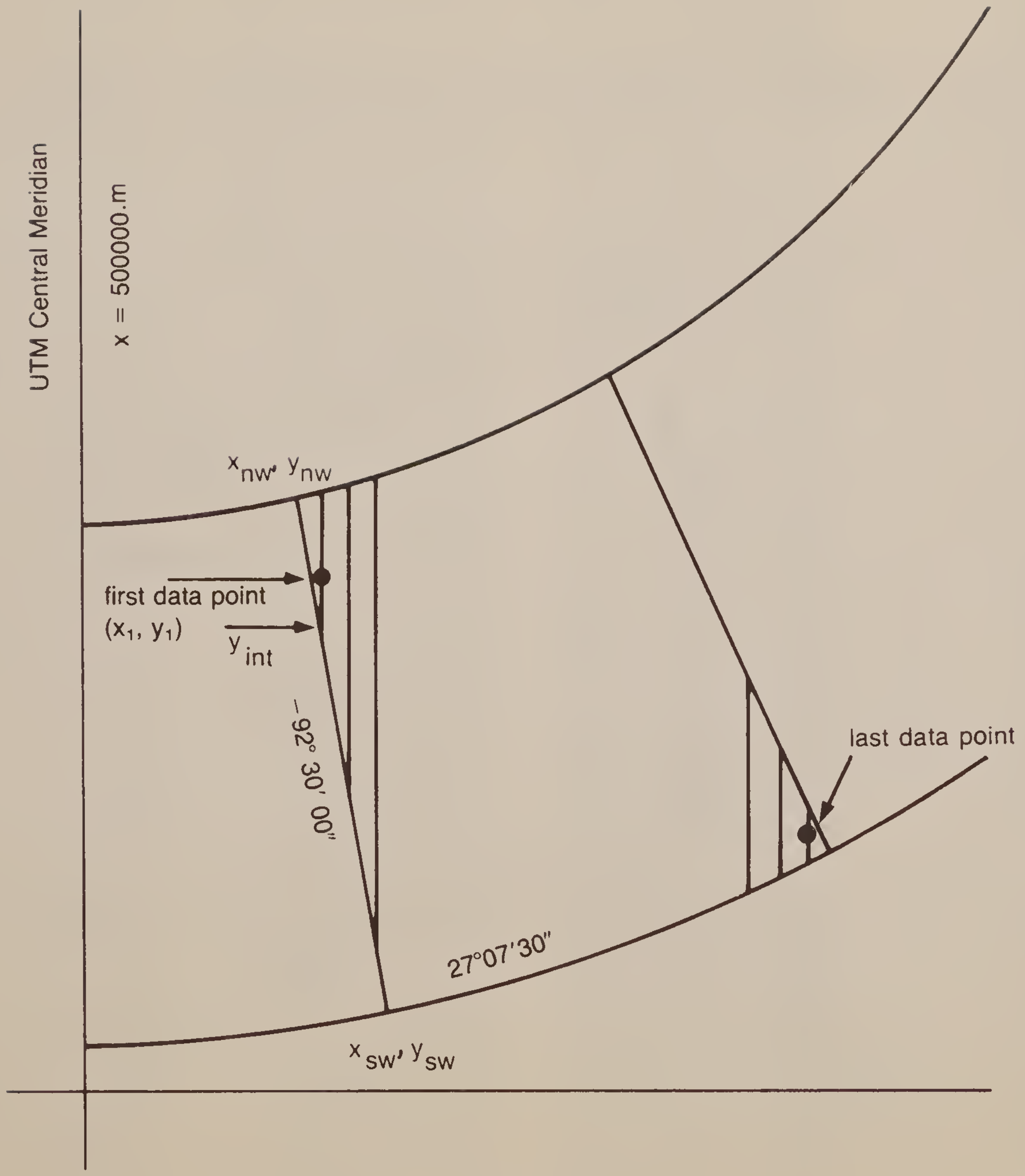
$y_{int} = b + mx_1$
= (-.0124897) (339120) + 3019237.443
= 3015001.936m

b) Compute y_1

$\frac{y_{int}}{30m} = \frac{3015001.936m}{30m}$
= 100500.06 (round up)

y_1 = 100501 (30m)
= 3015030m

Figure 3.--Computation of first data point in a 7.5-minute Digital Elevation Model west of the central meridian.



Example computation of UTM coordinates (x_1,y_1) of the first data point in a 7.5-minute DEM east of the central meridian.

The southwest corner of the 7.5-minute DEM in this example is at latitude 27°07'30", longitude -92°30'00" (x_{sw} =549553.918m, y_{sw}=3000211.052). The northwest corner is at latitude 27°15'00", longitude -92°35'00" (x_{nw} =549498.713m, y_{nw} =3014056.068m).

Compute x coordinate (x_1) of the first profile. The first profile is offset to the next integer multiple of 30 m east of the northwest corner.

$$\begin{aligned} \frac{x_{nw}}{30\text{m}} &= \frac{549498.713\text{m}}{30\text{m}} \\ &= 18316.6 \text{ (round up)} \\ &= 18317 \\ x_1 &= 18317\ (30\text{m}) \\ &= 549510\text{m} \end{aligned}$$

Compute y coordinate (y_1) of the first data point on the first profile. The first data point is offset to the next integer multiple of 30 m north of the intercept (y_{int}) of the first profile with the western longitude line of the 7.5-minute quadrangle.

(a) Use the slope intercept formula $y = mx + b$ to compute y_{int}.

$$\begin{aligned} m &= (y_{nw}-y_{sw})/(x_{nw}-x_{sw}) \\ &= 13845.016/-55.205 \end{aligned}$$

$$\begin{aligned} b &= y_{sw} - mx_{sw} \\ &= 3000211.052\text{m} - [(-250.79)(549553.919)] \\ &= 140822838.147\text{m} \end{aligned}$$

$$\begin{aligned} y_{int} &= b + mx_1 \\ &= 140822838.147\text{m} + [(-250.79)(549510\text{m})] \\ &= 3011225.247\text{m} \end{aligned}$$

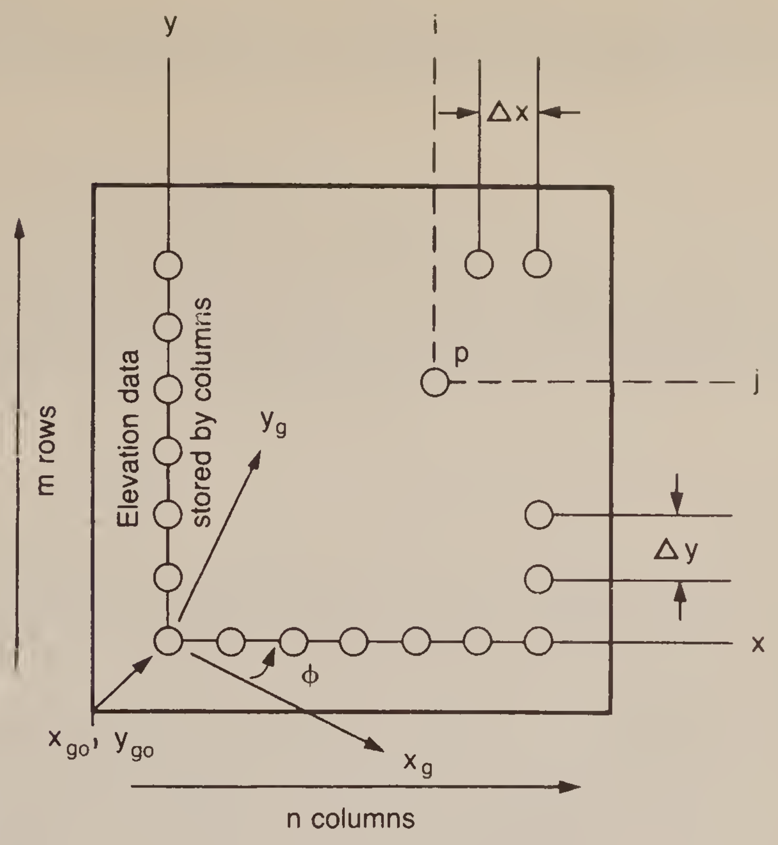
(b) Compute y_1

$$\begin{aligned} \frac{y_{int}}{30\text{m}} &= \frac{3011225.247\text{m}}{30\text{m}} \\ &= 100374.175 \text{ (round up)} \\ y_1 &= 100375\ (30\text{m}) \\ &= 3011250\text{m} \end{aligned}$$

Figure 4.--Computation of first data point in a 7.5-minute Digital Elevation Model east of the central meridian.

$$x_p = (i-1)\,\Delta x \qquad (1)$$

$$y_p = (j-1)\,\Delta y$$



$$x_{gp} = x_{go} + x_p\cos\phi - y_p\sin\phi \qquad (2)$$

$$y_{gp} = y_{go} + x_p\sin\phi + y_p\cos\phi$$

Figure 5.--Geometry and nomenclature of the 7.5-minute Digital Elevation Model file.

The method of determining 7.5-minute DEM accuracy involves computation of the root-mean-square error (RMSE) for linearly interpolated elevations in the DEM and corresponding "true" elevations from the published maps. Test points are well distributed, are representative of the terrain, and have "true" elevations well within the DEM accuracy criteria.

Test points are located on contour lines, bench marks, or spot elevations. A minimum of 28 test points a DEM is required (20 interior points and 8 edge points). Collection of test point data and comparison of the DEM to the quadrangle hypsography are conducted by the quality-control units within the USGS.

The broad DMA production objective for a 1-degree DTED-1 is to satisfy an absolute horizontal accuracy (feature to datum) of 130 m, circular error at 90-percent probability; and an absolute vertical accuracy (feature to mean sea level) of ±30 m, linear error at 90-percent probability. The relative horizontal and vertical accuracy (feature to feature on the surface of the elevation model), although not specified, will in many cases conform to the actual hypsographic features with higher integrity than indicated by the absolute accuracy.

CLASSIFICATION LEVELS

The following is a description of the general data characteristics used to classify DEM's into one of three levels of quality. There are varying methods of data collection and degrees of editing available for DEM data. Classification levels are indicated in the DEM record A (appendix A).

Level 1

Level 1 DEM's are elevation data sets in a standardized format. The intent is to reserve this level for 7.5-minute DEM's or equivalent that are derived from scanning National High-Altitude Photography Program, National Aerial Photography Program, or equivalent photography.

A vertical RMSE of 7 m is the desired accuracy standard. A RMSE of 15 m is the maximum permitted. The intent for 7.5-minute DEM data at this level is that an absolute elevation error tolerance of 50 m (approximately three times the 15-meter RMSE) be set for blunders for any grid node when compared to the true height from mean sea level, or that an array of points not encompass more than 49 contiguous elevations and be in error by more than 21 m (three times the 7-m RMSE). Systematic errors within the stated accuracy standards are tolerated at this level.

DEM data acquired photogrammetrically by using manual profiling or the Gestalt Photo Mapper are restricted to the level 1 category. DEM's with a RMSE of from 7 to 15 meters in elevation are being retained as an intermediate product and eventually will be replaced by higher accuracy DEM's. The DEM record C (appendix C) contains the RMSE accuracy statistics acquired during quality control.

An interim 30-minute DEM product has been produced by regridding 7.5-minute DEM data. These interim DEM's are labeled as level 1 DEM's and carry a measured RMSE in record C. A tolerance has not been set for this RMSE, as a minimum level of accuracy has been satisfied previously with the data sets origin in the 7.5-minute DEM program.

Level 2

Level 2 DEM's are elevation data sets that have been processed or smoothed for consistency and edited to remove identifiable systematic errors. DEM data derived from hypsographic and hydrographic data digitizing, either photogrammetrically or from existing maps, are entered into the level 2 category after review on a DEM Editing System. An RMSE of one-half contour interval is the maximum permitted. There are no errors greater than one contour interval in magnitude. The DEM record C contains the accuracy statistics acquired during quality control.

Level 3

Level 3 DEM's are derived from DLG data by using selected elements from both hypsography (contours, spot elevations) and hydrography (lakes, shorelines, drainage). If necessary, ridge lines and hypsographic effects of major transportation features are also included in the derivation. A

RMSE of one-third of the contour interval is the maximum permitted. There are no errors greater than two-thirds contour interval in magnitude. The DEM record C contains the accuracy statistics acquired during quality control.

DIGITAL ELEVATION MODEL CAVEATS

Virtually all of the 7.5-minute DEM's produced to date are level 1. Only a limited number of 7.5-minute DEM's have been generated by interpolation from digital contours and are classified as level 2. The USGS does not currently produce level-3 DEM data.

All 30-minute DEM's derived from contours are level 2. All 30-minute DEM's derived from 7.5-minute DEM's are level 1.

All 1-degree DMA DTED-l's have been classified as level 3 because the hypsographic information, when plotted at 1:250,000 scale is consistent with the planimetric features normally found on 1:250,000-scale topographic maps. Inconsistencies may exist, but these are regarded as isolated cases to be tempered by the 90-percent confidence level for the overall product. NOTE: The USGS classification of "level 3" for 1-degree DEM's is not to be confused with the DMA'S "DTED level 1." In the DMA, the term "level" is related to the spatial resolution of the data and not to the quality of the data. For example, DTED level 2 (which the USGS does not distribute) would have an array spacing of 1 x 1 arc-second for latitudes south of 50° N.

DATA RECORDS

A DEM file is organized into a series of three logical records are formatted as shown in appendixes A, B, and C. Because the definition of a new element within what was formerly defined as element 1, record type A, the element counts of old record type A elements 2-15 (see table 1) have been incremented by one to elements 3-16 (see appendix A). A one-to-one correspondence still exists between the informational content of byte positions of elements in the old and new records. Therefore, DEM programs that expected elements 2-15 in specific byte positions in the DEM file will find the same information in those byte positions in the new files. In essence, this change is transparent to old DEM applications programs. Also, new data elements 17-28 have been appended to the end of the record A (see appendix A). These elements are contained in the end of the previously blank filled portion of the 1,024 byte record. This change is also expected to be transparent to existing DEM programs.

Appendixes D-G consist of code definitions that are needed to interpret various data elements in the three records. The type A record contains information defining the general characteristics of the DEM, including descriptive header information relating to the DEM's name, boundaries, units of measurement, minimum and maximum data values, number of type B records, and projection parameters. There is only one type A record for each DEM file, and it appears as the first record in the data file. The type B record contains elevation data and associated header information. All type B records of the DEM files are made up of data from one-dimensional bands called profiles. Therefore, the number of complete profiles covering the DEM area is synonymous with the number of type B records in the DEM. The type C record contains statistics on the accuracy of the data in the file.

The physical structure of the DEM distributed to the user is as follows:

- Data recorded in fixed-block format on unlabeled or ANSI-labeled 9-track magnetic tape at 1,600 or 6,250 bpi density.

- Logical record size of 1,024 bytes. No more than one logical record type (A, B, or C) recorded in any 1,024-byte record. However, more than one 1,024-byte record is usually required to store a single record type B. The logical record is padded with blanks if necessary to fill to the end of the logical record. Bytes 1,021-1,024 of each logical record are padded with blanks.

- Physical record size of 4,096 bytes; that is, 4 logical records per physical record.

- Data written as ANSI-standard ASCII characters.

Sample Data Records

Following are sample sets of A, B, and C records, corresponding to a typical 7.5-minute DEM (tables 1, 2, and 3), and sample sets of A and B records for a typical 1-degree DEM (tables 4 and 5). Included in these samples are literal ASCII listings of records directly from DEM distribution tapes. Following the literal listings are tabular explanations of each element in the type A, B, and C records. The tabular explanations may be used as direct references between the literal listings and the logical record type formats shown in appendixes A-C. Appendixes D-G consist of code definitions that are needed to interpret various data elements in the three records.

SAMPLE APPLICATIONS

The DEM files may be used in the generation of graphics such as isometric projections displaying slope, direction of slope, and terrain profiles between designated points. They may also be combined with other data types such as stream locations and weather data to plan forest fire control, or with remote sensing data to classify vegetation. Many nongraphic applications such as modeling terrain gravity data for use in locating energy resources, determining the volume of proposed reservoirs, calculating the amount of material removed during strip mining, and determining landslide probability have also been developed. Figures 6 and 7 show two graphic applications of DEM's.

Table 1.--Sample DEM Type A Logical Record--Mannboro, Virginia, Quadrangle (7.5 minute)

```
MANNBORO,VA
         EMC 2     1     1    18   0.0                     0.0                     0.0                     0.0                     0.0
                     0.0                     0.0                     0.0                     0.0                     0.0
       0.0                     0.0                     0.0                     0.0                     0.0                       2
 2     4   0.244998676000000D+06   0.412627656700000D+07   0.245420930000000D+06   0.414014832600000D+07   0.256491863000000D+06   0.4
13981850700000D+07   0.256087907000000D+06   0.412594681300000D+07   0.470000000000000D+02   0.114000000000000D+03   0.0
         10.300000E+020.300000E+020.100000E+01     1   383    00   10163008908I5 0 2 1   1
```

Data Element	Content	Explanation
1	MANNBORO, VA	Quadrangle name field.
FILLER		Bytes 41-140 reserved for future use.
2	EMC	Mapping Center origin code indicating that DEM was created in Eastern Mapping Center.
3	2	DEM level code indicating DEM level 2, synonomous with file created from DLG to DEM interpolation software.
4	1	Pattern code indicating either a regular or random elevation pattern; 1 indicates a regular pattern.
5	1	Planimetric reference system code; 1 indicates UTM coordinate system.
6	18	Code defining the zone in the ground planimetric reference system (i.e., UTM zone 18).
7	0.0 (15 sets of 0.0)	Map projection parameters; all 15 fields are set to zero for the UTM coordinate system and should be ignored.
8	2	Units code; 2 represents meters as the unit of measure for ground planimetric coordinates throughout this file.
9	2	Units code; 2 represents meters as the unit of measure for elevation coordinates throughout this file.
10	4	Number (n) of sides in the polygon which defines the coverage of the DEM file (usually equal to 4).

Table 1.--Sample DEM Type A Logical Record--Mannboro, Virginia Quadrangle (7.5 minute)--continued

Data Element	Content	Explanation
11	0.2449986...D+06	A 4,2 array containing the ground coordinates of the four corners of the DEM. Translation to decimal format yields: 244998.7, 4126276.6; 245420.9, 4140148.3; 256491.9, 4139818.5; 256087.9 4125946.8.
12	0.47.....D+02 0.114....D+03	Minimum and maximum elevations for the DEM.
13	0.0	Counterclockwise angle (in radians) from the primary axis of ground planimetric reference to the primary axis of the DEM local reference system.
14	1	Accuracy code; 1 indicates that a record of accuracy exists and is contained in record type C.
15	0.3000000E+02 0.3000000E+02 0.1000000E+01	A three-element array containing DEM spatial resolution (x, y, z); usually set to 30, 30, 1.
16	1 383	A two-element array containing the number of rows and columns of profiles in the DEM. The row value m is usually set to 1 as an indication that the arrays are actually one-dimensional profiles. The column value n equaling 383 indicates that the DEM file consists of a total of 383 profiles.

Table 1.--Sample DEM Type A Logical Record--Mannboro, Virginia Quadrangle (7.5 minute)--continued

Data Element	Content	Explanation
17	0	Indicates no largest contour interval.
18	0	Contour interval (set to 0 if previous data field is 0).
19	10	Smallest contour interval; indicates a standard 10-foot contour interval for the source quadrangle.
20	1	Contour units; 1 represents foot contours in multiples specified in the previous data field.
21	63 00	Data source date; this DEM was generated from contours which were compiled photogrametrically in 1963. Numbers 00 indicate month is not specified. The quadrangle was photorevised in 1987; however, no significant changes were made to the contours, therefore the date of 1963 takes precedence.
22	89 08	Data inspection date; this DEM was tested and inspected on the DES on August 1989.
23	I	Inspection/revision flag; in this case, this is a new data set which has been inspected but not revised.
24	5	Data validation flag; qualitative and quantitative tests appropriate to DEM level 2 data have been performed.
25	0	Suspect/void flag; 0 indicates none.
26	2	Vertical datum; 2 indicates DEM vertical datum is National Geodetic Vertical Datum 1929 (NGVD 29).
27	1	Horizontal Datum; 1 indicates DEM horizontal datum is North American Datum of 1927 (NAD 27).
28	1	Data edition; 1 indicates this is the first edition.

Table 2.--Sample DEM Type B Logical Record--Mannboro, Virginia Quadrangle (7.5 minute)

```
     1      4   111      1   0.245100000000000D+06   0.412629000000000D+07   0.0                        0.540000000000000D+02
0.870000000000000D+02    78     79     79     80     80     79     80     79     76     73     73     77     80     80     81     81     81
81     82     83     83    83     83     83     82     82     83     84     84     84     84     84     85     86     86     87     87     87     87
  87     87     87     86     85    85     84     83     82     82     82     82     82     83     84     85     85     84     83     83     82
82     80     76     75     74     75     74     74     73     71     68     68     65     64     61     60     60     61     60     58     58
57     57     57     56     56     55     55     55   55     55     54     55     55     55     55     56     56     56     56     57     57     57
  58     58     60     61     61     61     61     61
```

Data Element	Content	Explanation
1	1 4	Row and column identification number of the profile contained in this record; 1, 4 represents row 1, column 4, in the DEM data set.
2	111 1	Number of rows (elevations) and column in this profile; 111, 1 indicates there are 111 elevations and 1 column in this profile.
3	0.245100...D+06 0.4126290...D+07	Translated to the decimal, 245100.0 and 4126290.0 are the ground planimetric coordinates (UTM) of the first elevation in the profile.
4	0.0	Elevation of local datum for the profile.
5	0.54....D+02 0.87....D+02	Minimum and maximum elevations for the profile.
6	78 79... ....61 61	An array of m x n elevations (m=111, n=1) for the profile expressed in units of measure of meters (record A, element 9, indicates meters as units of measure) above or below the local datum (record A, element 26).

Table 3.--Sample DEM Type C Logical Record--Mannboro, Virginia Quadrangle (7.5 minute)

```
1   0   0   3   0   1   0   0   1  23
```

Data Element	Content	Explanation
1	1	Availability code; 1 indicates that an absolute accuracy estimate does exist for this file.
2	0 0 3	Absolute accuracy RMSE estimate (in x, y, and z); the first two zeros indicate that the x and y relative statistics are not available. A 3 in this field indicates that a vertical solution of 3 meters or less was computed for the source data control network.
3	0	A 0 implies that this test occured prior to and is independant of the DEM collection process and that the number of test points is irrelevant.
4	1	Availability code; 1 indicates that statistics are available in the next element.
5	0 0 1	RMSE of DEM data relative to datum (in x, y, and z); the first two zeros indicate that the x and y relative statistics are not available. The value 1 meaning 1-meter RMSE indicates that the DEM met relative vertical (z) accuracy criteria for the 7-meter data base.
6	23	Sample size code; 23 indicates that the relative statistic of element 5 is based on 23 vertical test points.

Table 4.--Sample DEM Type A Logical Records--Reno, Nevada-California, Quadrangle (West Half) (1 degree)

```
NJ11-01W
             3     1     0     0   0.0                     0.0                     0.0                     0.0                     0.0
                     0.0                     0.0                     0.0                     0.0                     0.0
       0.0                     0.0                     0.0                     0.0                     0.0                       3
 2     4  -0.428400000000000D+06   0.140400000000000D+06  -0.428400000000000D+06   0.144000000000000D+06  -0.424800000000000D+06   0.1
44000000000000D+06  -0.424800000000000D+06   0.140400000000000D+06   0.999000000000000D+03   0.264100000000000D+04   0.0
         00.300000E+010.300000E+010.100000E+01     1  1201
```

Data Element	Content	Explanation
1	NJ11-01W	Quadrangle name field (144 characters); NJ11-01W is the designation for the DEM covering the west half of the Reno, Nevada-California, sheet.
2	3	DEM level code; 3 reflects processing by DMA which includes registration to planimetric features appearing on the source 1-degree topographic map.
3	1	Pattern code; 1 indicates a regular elevation pattern.
4	0	Planimetric reference system code; 0 indicates geographic coordinate system.
5	0	Zone code; there are no zones in the geographic system. Therefore, the zone code is set to zero.
6	0.0 (15 sets of 0.0)	Map projection parameters; all 15 fields are set to zero for the geographic system and should be ignored. Presence of non-zero parameters are not related to the geographic coordinate system and should also be ignored.
7	3	Units code; 3 represents arc-seconds as the unit of measure for ground planimetric coordinates throughout the file.
8	2	Units code; 2 represents meters as the unit of measure for elevation coordinates throughout the file.
9	4	Number (n) of sides in the polygon which defines the coverage of the DEM file (usually equal to 4).

Table 4.--Sample DEM Type A Logical Records--Reno, Nevada-California,

Quadrangle (West Half) (1 degree)--continued

Data Element	Content	Explanation
10	-0.4284...D+06, 0.1404...D+06 .... -0.4248...D+06 0.1404...D+06	A 4,2 array containing the ground coordinates of the four corners of the DEM. In this case translation from arc-seconds to degrees, minutes, and seconds yields: -119 00 00, 39 00 00; -119 00 00, 40 00 00; -118 00 00, 40 00 00; -118 00 00, 39 00 00.
11	0.9990...D+03 0.2641...D+04	Minimum and maximum elevations for the DEM.
12	0.0	Counterclockwise angle from the primary axis of ground planimetric reference to the primary axis of the DEM local reference system.
13	0	Accuracy code; 0 indicates that a record of accuracy does not exist and that no record type C will follow.
14	0.3000000E+01 0.3000000E+01 0.1000000E+01	A three-element array containing DEM spatial resolution (x, y, z); set to 3, 3, 1; or 3, 6, 1; or 3, 9, 1 depending on the latitude of the product.
15	1 1201	A two-element array containing the number of rows and columns of profiles in the DEM. The row value m is usually set to 1 as an indication that the arrays are actually one-dimensional profiles. The column value n set to 1,201 indicates that the DEM file consists of a total of 1,201 profiles.

Table 5.--Sample DEM Type B Logical Record--Reno, Nevada-California, Quadrangle (West Half) (1 degree)

```
    1     1  1201     1  -0.428400000000000D+06   0.140400000000000D+06   0.0                     0.121200000000000D+04
0.177200000000000D+04  1538  1539  1539  1534  1529  1520  1513  1508  1501  1493  1488  1483  1479  1475  1474  1473  1472
1469  1469  1467  1466  1464
```

(As per 7.5-minute DEM's, element 6 contains elevations for the DMA DEM. This field always contains 1,201 data elements per record. See Data Element 6.)

```
                                                        1422  1417  1412  1405  1401  1396  1391  1392  1394  1397  1398
1397  1398  1398  1397  1394  1390  1386  1383  1380  1377  1374  1372  1369  1367  1366  1367  1368  1368  1369  1369  1370
1371  1371  1371  1371  1370  1371  1372  1370  1373  1373  1372  1376  1375  1374  1374  1372  1372  1374  1374  1374  1374
1376  1378  1381
```

Data Element	Content	Explanation
1	1 1	Row and column identification number of the profile contained in this record; 1, 1 represents row 1, column 1, in the DEM data set.
2	1201 1	Number of rows (elevations) and columns in this profile; 1201, 1 indicates there are 1,201 elevations and 1 column in this profile.
3	-0.4284...D+06 0.1404...D+06	Translated to the decimal, -428400.0 and 1404000.0 are the ground planimetric coordinates (arc-seconds) of the first elevation in the profile, thus computed equal to -119 and 39 degrees.
4	0.0	Elevation of local datum for the profile. Always zero for 1-degree DEM, the reference is mean sea level.
5	0.1212...D+04 0.1772...D+04	Minimum and maximum elevations for the profile.
6	1538 1539... ....1378 1381	An array of m x n elevations (m=1201, n=1) for the profile expressed in units of measure of meters (record A, element 8, indicates meters as units of measure) above or below the local datum (record a, element 4).

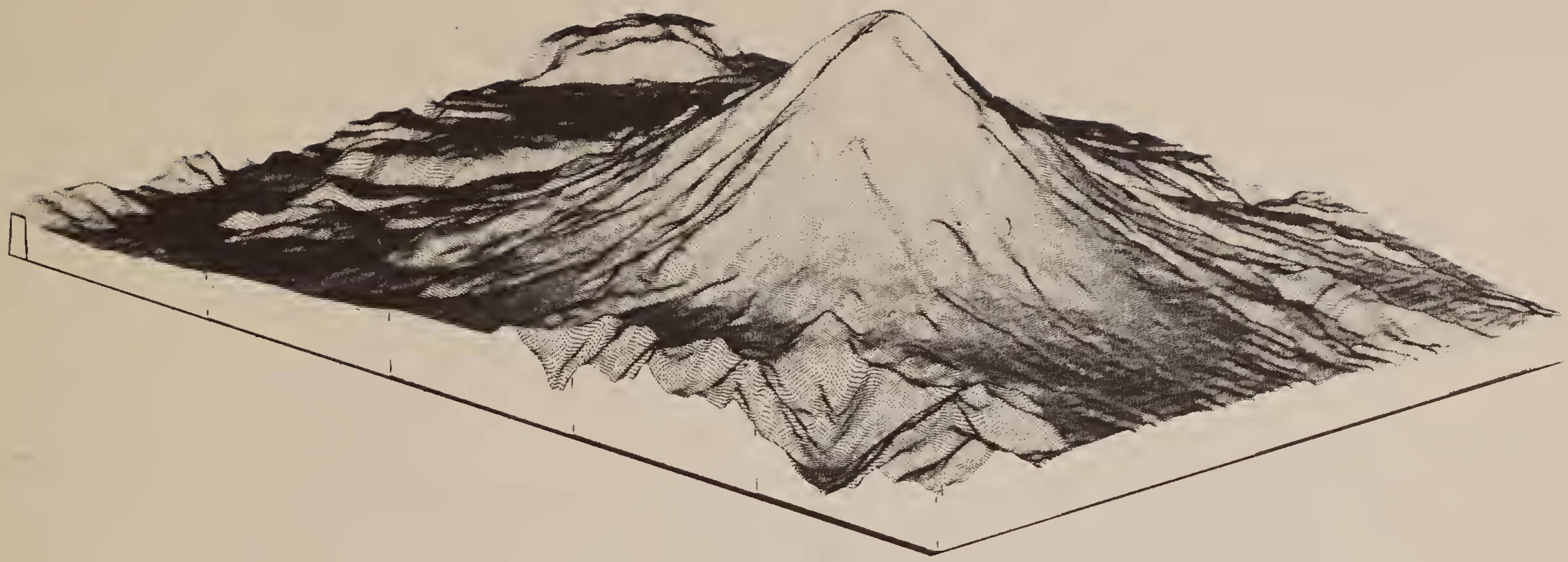


Figure 6.--Preeruption isometric plot of Mount St. Helens 7.5-minute Digital Elevation Models generated from data obtained from July 15, 1979, photographs. View is from the northeast at a 45° altitude angle; vertical exaggeration is 3:1.

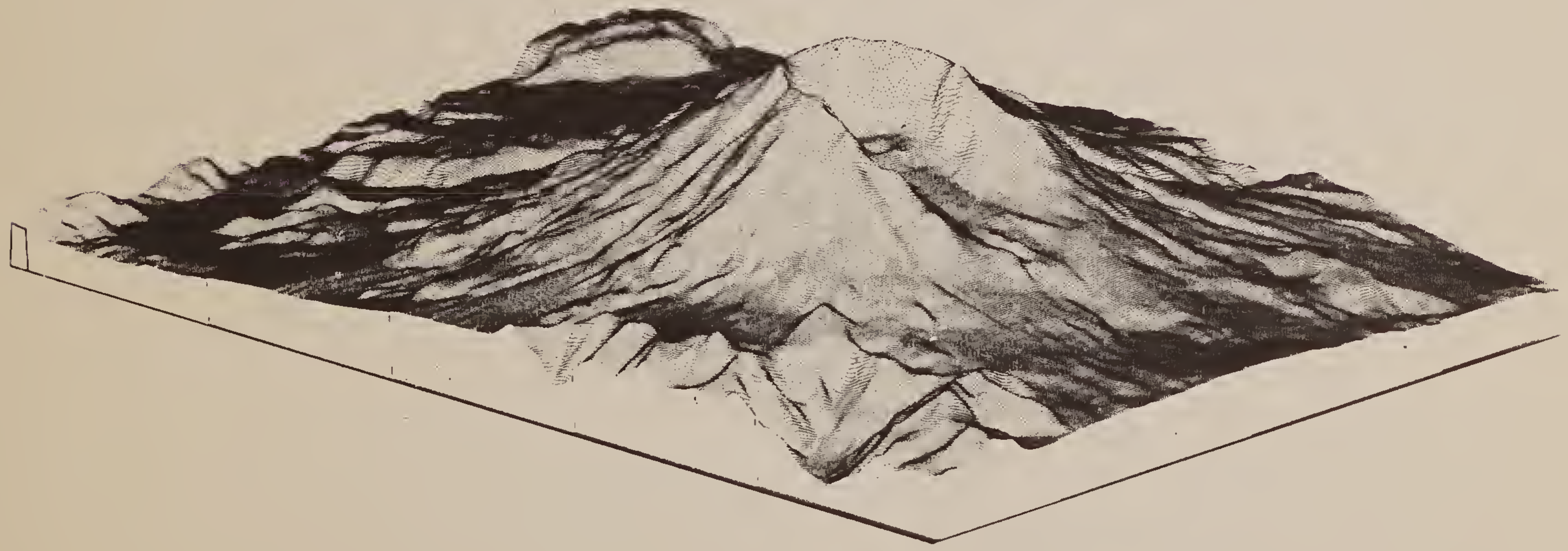


Figure 7.--Posteruption isometric plot of Mount St. Helens 7.5-minute Digital Elevation Models generated from data obtained from September 6, 1980, photographs. View is from the northeast at a 45° altitude angle; vertical exaggeration is 3:1.

APPENDIXES

APPENDIX A.--Digital Elevation Model Data Elements
Logical Record Type A

Data Element		Type (FORTRAN Notation)	Physical Record Format			Comment
			ASCII Format	Starting byte	Ending byte	
1	File name	ALPHA	A40	1	40	Authorized DEM quadrangle name.
	Free Format Text	ALPHA	A40	41	80	Free format descriptor field, contains useful information related to digital process such as digitizing instrument, photo codes, slot widths, etc.
	Filler	---	---	81	135	
	Process Code	ALPHA	A1	136		Code 1=GPM 2=Manual Profile 3=DLG2DEM (includes any DLG type process such as CTOG or LINETRACE) 4=DCASS
	Filler	---	---	137		
	Sectional Indicator	ALPHA	A3	138	140	This code is specific to 30-minute DEM's. Identifies 1:100,000-scale sections. Formatted as XNN, where X is "s"=7.5-minute, "F"=15-minute, and NN is a two-digit sequence number.
2	MC origin code	ALPHA	A4	141	144	Mapping Center origin Code. Valid codes are EMC, WMC, MCMC, RMMC, FS, GPM2.
3	DEM level code	INTEGER*2	I6	145	150	Code 1=DEM-1 2=DEM-2 3=DEM-3
4	Code defining elevation pattern (regular or random)	INTEGER*2	I6	151	156	Code 1=regular 2=random is reserved for future use.

APPENDIX A.--Digital Elevation Model Data Elements
Logical Record Type A--continued

Data Element		Type (FORTRAN Notation)	Physical Record Format			Comment
			ASCII Format	Starting byte	Ending byte	
5	Code defining ground planimetric reference system	INTEGER*2	I6	157	162	Code 0=Geographic 1=UTM 2=State plane For codes 3-20, see appendix F. Code 0 represents the geographic (latitude/longitude) system for 30-minute, 1-degree and Alaska DEM's. Code 1 represents the current use of the UTM coordinate system for 7.5-minute DEM's.
6	Code defining zone in ground planimetric reference system	INTEGER*2	I6	163	168	Codes for State plane and UTM coordinate zones are given in appendixes D and E for 7.5-minute DEM's. Code is set to zero if element 5 is also set to zero defining data as geographic.
7	Map projection parameters (see appendix F)	REAL*8	15D24.15	169	528	Definition of parameters for various projections is given in appendix F. All 15 fields of this element are set to zero and should be ignored when geographic, UTM, or State plane coordinates are coded in data element 5.
8	Code defining unit of measure for ground planimetric coordinates throughout the file	INTEGER*2	I6	529	534	Code 0=radians 1=feet 2=meters 3=arc-seconds Normally set to code 2 for 7.5-minute DEM's. Always set to code 3 for 30-minute, 1-degree, and Alaska DEM's.

APPENDIX A.--Digital Elevation Model Data Elements
Logical Record Type A--continued

Data Element		Type (FORTRAN Notation)	Physical Record Format			Comment
			ASCII Format	Starting byte	Ending byte	
9	Code defining unit of measure for elevation coordinates throughout the file	INTEGER*2	I6	535	540	Code 1=feet 2=meters Normally code 2, meters, for 7.5-minute, 30-minute, 1-degree, and Alaska DEM's.
10	Number (n) of sides in the polygon which defines the coverage of the DEM file	INTEGER*2	I6	541	546	n=4.
11	A 4,2 array containing the ground coordinates of the four corners for the DEM	REAL*8	4(2D24.15)	547	738	The coordinates of the quadrangle corners are ordered in a clockwise direction beginning with the southwest corner. The array is stored row-wise as pairs of eastings and northings.
12	A two-element array containing minimum and maximum elevations for the DEM	REAL*8	2D24.15	739	786	The values are in the unit of measure given by data element 9 in this record.
13	Counterclockwise angle (in radians) from the primary axis of ground planimetric reference to the primary axis of the DEM local reference system	REAL*8	D24.15	787	810	See figure 5. Set to zero to align with the coordinate system specified in element 5.

APPENDIX A.--Digital Elevation Model Data Elements
Logical Record Type A--continued

Data Element		Type (FORTRAN Notation)	Physical Record Format			Comment
			ASCII Format	Starting byte	Ending byte	
14	Accuracy code for elevations	INTEGER*2	I6	811	816	Code 0=unknown accuracy 1=accuracy information is given in logical record type C.
15	A three-element array of DEM spatial resolution for x, y, z. Units of measure are consistent with those indicated by data elements 8 and 9 in this record	REAL*4	3E12.6	817	852	These elements are usually set to; 30, 30, 1 for 7.5-minute DEM's; 2, 2, 1 for 30-minute DEM's; 3, 3, 1 for 1-degree DEM's. 2, 1, 1 for high resolution DEM's in Alaska 3, 2, 1 for low resolution DEM's in Alaska. 7.5-minute DEM'S will eventually be converted to geographics, i.e., 1,1,1.
16	A two-element array containing the number of rows and columns (m,n) of profiles in the DEM	INTEGER*2	2I6	853	864	When the row value m is set to 1 the n value describes the number of columns in the DEM file. Raw GPM data files are set to m=16, n=16.
Note:	*Old format stops here*					
17	Largest primary contour interval	INTEGER*2	I5	865	869	Present only if two or more primary intervals exist.
18	Source contour interval units	INTEGER*1	I1	870		Corresponds to the units of the map largest primary contour interval 0=N.A., 1=feet, 2=meters.
19	Smallest primary	INTEGER*2	I5	871	875	Smallest or only primary contour interval
20	Source contour interval units	INTEGER*1	I1	876		Corresponds to the units of the map smallest primary contour interval. 1=feet, 2=meters.

APPENDIX A.--Digital Elevation Model Data Elements
Logical Record Type A--continued

Data Element		Type (FORTRAN Notation)	Physical Record Format			Comment
			ASCII Format	Starting byte	Ending byte	
21	Data source date	INTEGER*2	I4	877	880	YYMM two-digit year and two-digit month MM = 00 for source having year only.
22	Data inspection/ revision date	INTEGER*2	I4	881	884	YYMM two-digit year and two-digit month.
23	Inspection/ revision flag	ALPHA*1	A1	885		"I" or "R"
24	Data validation flag	INTEGER*1	I1	886		0= No validation performed. 1=TESDEM (record C added) no qualitative test (no DEM Edit System [DES] review). 2=Water body edit and TESDEM run. 3=DES (includes water edit) no qualitative test (no TESDEM). 4=DES with record C added, qualitative and quantitative tests for level 1 DEM. 5=DES and TESDEM qualitative and quantitative tests for levels 2 and 3 DEM's.

APPENDIX A.--Digital Elevation Model Data Elements
Logical Record Type A--continued

Data Element		Type (FORTRAN Notation)	Physical Record Format			Comment
			ASCII Format	Starting byte	Ending byte	
25	Suspect and void area flag	INTEGER*1	I2	887	888	0=none 1=suspect areas 2=void areas 3=suspect and void areas
26	Vertical datum	INTEGER*1	I2	889	890	1=local mean sea level 2=National Geodetic Vertical Datum 1929 (NGVD 29) 3=North American Vertical Datum 1988 (NAVD 88)
27	Horizontal datum	INTEGER*1	I2	891	892	1=North American Datum 1927 (NAD 27) 2=World Geodetic System 1972 (WGS 72) 3=WGS 84 4=NAD 83 5=Old Hawaii Datum 6=Puerto Rico Datum 7=NAD 83 Provisional (shifts in horizontal coordinates are computed, but old DEM nodes are not resampled)
28	Data Edition	INTEGER*2	I4	893	896	01-99 Primarily a DMA specific field.

APPENDIX B.--Digital Elevation Model Data Elements
Logical Record Type B

Data Element		Type (FORTRAN Notation)	Physical Record Format			Comment
			ASCII Format	Starting byte	Ending byte	
1	A two-element array containing the row and column identification number of the DEM profile contained in this record	INTEGER*2	2I6	1	12	See figure 5. The row/column numbers may range from 1 to m and 1 to n. The row number is normally set to 1. The column identification is the profile sequence number.
2	A two-element array containing the number (m, n,) of elevations in the DEM profile	INTEGER*2	2I6	13	24	See figure 5. The first element in the field corresponds to the number of rows and columns of nodes in this profile. The second element is set to 1, specifying 1 column per B record.
3	A two-element array containing the ground planimetric coordinates (X_{go}, Y_{go}) of the first elevation in the profile	REAL*8	2D24.15	25	72	See figure 5.
4	Elevation of local datum for the profile	REAL*8	D24.15	73	96	The values are in the units of measure given by data element 9, logical record type A.

APPENDIX B.--Digital Elevation Model Data Elements
Logical Record Type B--continued

Data Element		Type (FORTRAN Notation)	Physical Record Format			Comment
			ASCII Format	Starting byte	Ending byte	
5	A two-element array of minimum and maximum elevations for the profile	REAL*8	2D24.15	97	144	The values are in the unit of measure given by data element 9 in logical record type A.
6	A m,n array of elevations for the profile. Elevations are expressed in units of resolution	INTEGER*2	mn(I6)	6x(146 or 170) 146 = max for first block. 170 = max for subsequent blocks		See data element 15 in appendix A. A value in this array would be multiplied by the spatial resolution value and added to the elevation of the local elevation datum for the element profile (data element 4 in this record) to obtain the elevation for the point. The planimetric ground coordinates of the point X_{gp}, Y_{gp}, are computed according to the formulas in figure 5.

APPENDIX C.--Digital Elevation Model Data Elements
Logical Record Type C

Data Element		Type (FORTRAN Notation)	Physical Record Format			Comment
			ASCII Format	Starting byte	Ending byte	
1	Code indicating availability of statistics in data element 2	INTEGER*2	I6	1	6	Code 1=available 0=unavailable
2	RMSE of file's datum relative to absolute datum (x, y, z)	INTEGER*2	3I6	7	24	In same units as indicated by elements 8 and 9 of logical record type A.
3	Sample size on which statistics in data element 2 are based	INTEGER*3	I6	25	30	If 0, then accuracy will be assumed to be estimated rather than computed.
4	Code indicating availability of statistics in data element 5	INTEGER*2	I6	31	36	Code 1=available 0=unavailable
5	RMSE of DEM data relative to file's datum (x, y, z)	INTEGER*2	3I6	37	54	In same units as indicated by elements 8 and 9 of logical record type A.
6	Sample size on which statistics in element 5 are based	INTEGER*2	I6	55	60	If 0, then accuracy will be assumed to be estimated rather than computed.

APPENDIX D.--Sample Quadrilateral Coordinates

Quad Corner No.	Geographic Coordinates		UTM Coordinates	
	Latitude	Longitude	Easting	Northing
1	35°30’	107°37'30"	261897	3931463
2	35°37'30"	107°37'30"	262267	3945330
3	35°37'30"	107°30'	273590	3945036
4	35°30'	107°30'	273238	3931169

APPENDIX E.--Codes for State Plane Coordinate Zones

Alabama, East (AL)	0101
Alabama, West	0102
Alaska (AK)	5001 thru 5010
Arizona, Central (AZ)	0203
Arizona, East	0201
Arizona, West	0202
Arkansas, North (AR)	0301
Arkansas, South	0302
California (CA)	0401 thru 0407
Colorado, Central (CO)	0502
Colorado, North	0501
Colorado, South	0503
Connecticut (CT)	0600
Delaware (DE)	0700
District of Columbia (DC)	1900
Florida, East (FL)	0901
Florida, North	0903
Florida, West	0902
Georgia, East (GA)	1001
Georgia, West	1002
Hawaii (HI)	5101 thru 5105
Idaho, Central (ID)	1102
Idaho, East	1101
Idaho, West	1103
Illinois, East (IL)	1201
Illinois, West	1202
Indiana, East (IN)	1301
Indiana, West	1303
Iowa, North (IA)	1401
Iowa, South	1402
Kansas, North (KS)	1501
Kansas, South	1502
Kentucky, North (KY)	1601
Kentucky, South	1602
Louisiana, North (LA)	1701
Louisiana, Off Shore	1703
Louisiana, South	1702
Maine, East (ME)	1801
Maine, West	1802
Maryland (MD)	1900
Massachusetts, Island (MA)	2002
Massachusetts, Mainland	2001
Michigan, Central (MI)	2102
Michigan, Central (Lambert)	2112
Michigan, East	2101
Michigan, North (Lambert)	2111
Michigan, South (Lambert)	2113
Michigan, West	2103
Minnesota, Central (MN)	2202
Minnesota, North	2201
Minnesota, South	2203
Mississippi, East (MS)	2301
Mississippi, West	2302
Missouri, Central (MO)	2402
Missouri, East	2401
Missouri, West	2403
Montana, Central (MT)	2502
Montana, North	2501
Montana, South	2503
Nebraska, North (NE)	2601
Nebraska, South	2602
Nevada, Central (NV)	2702
Nevada, East	2701
Nevada, West	2703
New Hampshire (NH)	2800
New Jersey (NJ)	2900
New Mexico, Central (NM)	3002
New Mexico, East	3001
New Mexico, West	3003
New York, Central (NY)	3102
New York, East	3101
New York, Long Island	3104
New York, West	3103
North Carolina (NC)	3200
North Dakota, North (ND)	3301
North Dakota, South	3302
Ohio, North (OH)	3401
Ohio, South	3402
Oklahoma, North (OK)	3501
Oklahoma, South	3502
Oregon, North (OR)	3601
Oregon, South	3602
Pennsylvania, North (PA)	3701
Pennsylvania, South	3702
Rhode Island (RI)	3800
South Carolina, North (SC)	3901
South Carolina, South	3902
South Dakota, North (SD)	4001
South Dakota, South	4002
Tennessee (TN)	4100
Texas, Central (TX)	4203
Texas, North	4201
Texas, North Central	4202
Texas, South	4205
Texas, South Central	4204

APPENDIX E.--Codes for State Plane Coordinate Zones--continued

Utah, Central (UT)	4302
Utah, North	4301
Utah, South	4303
Vermont (VT)	4400
Virginia, North (VA)	4501
Virginia, South	4502
Washington, North (WA)	4601
Washington, South	4602
West Virginia, North (WV)	4701
West Virginia, South	4702
Wisconsin, Central (WI)	4802
Wisconsin, North	4702
Wisconsin, South	4803
Wyoming, Zone I, East (WY)	4901
Wyoming, Zone II, East Central	4902
Wyoming, Zone III, West Central	4903
Puerto Rico (PR)	5301
Virgin Islands, St. Croix (VI)	5202
Virgin Islands, St. John, St. Thomas	5201
American Samoa (AS)	5300
Guam (GU)	5400

---

source: Federal Information Processing Standard (FIPS) Publication 70-1, 1986

APPENDIX F.--Universal Transverse Mercator Zone Locations and Central Meridians

Zone	C.M.	Range	Zone	C.M.	Range
01	177W	180W-174W	31	003E	000E-006E
02	171W	174W-168W	32	009E	006E-012E
03	165W	168W-162W	33	015E	012E-018E
04	159W	162W-156W	34	021E	018E-024E
05	153W	156W-150W	35	027E	024E-030E
06	147W	150W-144W	36	033E	030E-036E
07	141W	144W-138W	37	039E	036E-042E
08	135W	138W-132W	38	045E	042E-048E
09	129W	132W-126W	39	051E	048E-054E
10	123W	126W-120W	40	057E	054E-060E
11	117W	120W-114W	41	063E	060E-066E
12	111W	114W-108W	42	069E	066E-072E
13	105W	108W-102W	43	075E	072E-078E
14	099W	102W-096W	44	081E	078E-084E
15	093W	096W-090W	45	087E	084E-090E
16	087W	090W-084W	46	093E	090E-096E
17	081W	084W-078W	47	099E	096E-102E
18	075W	078W-072W	48	105E	102E-108E
19	069W	072W-066W	49	111E	108E-114E
20	063W	066W-060W	50	117E	114E-120E
21	057W	060W-054W	51	123E	120E-126E
22	051W	054W-048W	52	129E	126E-132E
23	045W	048W-042W	53	135E	132E-138E
24	039W	042W-036W	54	138E	138E-144E
25	033W	036W-030W	55	147E	144E-150E
26	027W	030W-024W	56	153E	150E-162E
27	021W	024W-018W	57	159E	156E-162E
28	015W	018W-012W	58	165E	162E-168E
29	009W	012W-006W	59	171E	168E-174E
30	003W	006W-000E	60	177E	174E-180W

APPENDIX G.--Parameters Required for Definition of Map Projections

Parameter	(00)* Geographic	(01)** Universal Transverse	(02) State Plane	(03) Albers Conical	(04) Lambert Conformal
Mercator (UTM)		Equal Area			
1	***	Longitude of any point within the zone	***	Semimajor axis of ellipsoid. If this field is left blank (=0), the value for Clarke's 1866 spheroid in meters will be assumed.	
2	***	Latitude of any point within the UTM zone	***	Eccentricity squared of ellipsoid (e^2). If field is zero, this will indicate a sphere. If the field is 1, this field will be interpreted as containing the semiminor axis of the ellipsoid.	
3	***	***	***	Latitude of 1st standard parallel	
4	***	***	***	Latitude of 2d standard parallel	
5	***	***	***	Longitude of central meridian	
6	***	***	***	Latitude of projection's origin	
7	***	***	***	False easting in the same units of measure as the semimajor axis of ellipsoid	
8	***	***	***	False northing in the same units of measure as the semimajor axis of ellipsoid	
9-15 (not used for projections on this page)					

* Projection code number.

** For the Northern Hemisphere, supplying UTM zone will result in ignoring any given projection parameters.

*** Parameter is not applicable to projection.

Note: All angles (latitudes, longitudes, or azimuth) are required in degrees, minutes, and arc-seconds in the packed real number format +DDDMMSS.SSSSS.

APPENDIX G.--Parameters Required for Definition of Map Projections--continued

Parameter	(05) Mercator	(06) Polar Stereographic	(07) Polyconic	(08) Equidistant Conic	
				Type A	Type B
1	Semimajor axis of ellipsoid. If this field is left blank (=0), the value for Clarke's 1866 spheroid in meters will be assumed.				
2	Eccentricity squared of ellipsoid (e). If field this is left blank (=0), this will indicate a sphere. If the field is 1, this field will be interpreted as containing the semiminor axis of the ellipsoid.				
3	***	***	***	Latitude of standard parallel	Latitude of 1st standard parallel
4	***	***	***	***	Latitude of 2d standard parallel
5	Longitude of Central Meridian	Longitude directed straight down below pole of map	. . . . . . Longitude of central meridian		
6	***	Latitude of true scale	. . . . . . Latitude of projection's origin		
7	. . . . . False easting in the same units of measure as the semimajor axis of ellipsoid				
8	. . . . . False northing in the same units of measure as the semimajor axis of ellipsoid				
9	***	***	***	Zero	Any non-zero number
10-15 (not used for projections on this page)					

APPENDIX G.--Parameters Required for Definition of Map Projections--continued

Parameter	(09) Transverse Mercator	(10) Stereographic	(11) Lambert Azimuthal Equal-Area	(12) Azimuthal Equidistant	(13) Gnomonic	(14) Orthographic
1	Same as projections 03 thru 08	. . . . .Radius of the sphere of reference . . . . If this field is left blank, the value 6370997.0 meters will be assumed				
2	Same as projections 03 thru 08	***	***	***	***	***
3	Scale factor at central meridian	***	***	***	***	***
4	***	***	***	***	***	***
5	Longitude of central meridian	. . . . .Longitude of center of projection				
6	Latitude of origin	. . . . Latitude of center of projection				
7	False easting in the same units of measure as the semimajor axis or radius of the sphere					
8	False northing in the same units of measure as the semimajor axis or radius of the sphere					
9-15 (not used for projections on this page)						

APPENDIX G.--Parameters Required for Definition of Map Projections--continued

Parameter	(15) General Vertical Near-Side Perspective	(16) Sinusoidal (Plate Caree)	(17) Equirectangular	(18) Miller Cylindrical	(19) Van Der Grinten I
1	. . . . Radius of the sphere of reference . . . . If this field is left blank, the value 6370997.0 meters will be assumed.				
2	***	***	***	***	***
3	Height of perspective point above sphere	***	***	***	***
4	***	***	***	***	***
5	Longitude of center of projection	. . . . Longitude of central meridian			
6	Latitude of center of projection	***	***	***	***
7	. . . . False easting in the same units of measure as radius of the sphere				
8	. . . . False northing in the same units of measure as radius of the sphere				
9-15 (not used for projections on this page)					

APPENDIX G.--Parameters Required for Definition of Map Projections--continued

Parameter	(20) Oblique Mercator (Definition Format A)	(20) Oblique Mercator (Definition Format B)
1	Same as for projections 03 thru 09	
2	Same as for projections 03 thru 09	
3	Scale factor at the center of projection	
4	***	Angle of azimuth east of north for central line of projection
5	***	Longitude of point along central line of projection at which angle of azimuth is measured
6	Latitude of origin of projection 12	
7	Same as for projections 03 thru 19	
8	Same as for projections 03 thru 19	
9	Longitude of first point defining central geodetic line of projection	***
10	Latitude of first point defining central geodetic line of projection	***
11	Longitude of second point defining central geodetic line of projection	***
	Latitude of second point defining central geodetic line of projection	***
13	Zero	Any non-zero number
14 and 15 (not used for this projection)		

APPENDIX H.--National and International Datums Used for Digital Elevation Data

Two types of horizontal datums are presently in use for DEM data distributed by the USGS, the civilian North American Datum (NAD) and military World Geodetic System (WGS). The NAD 27 datum is currently used to define positions on USGS topographic maps and 7.5-minute DEM's. Plans are to convert to the new NAD 83 for these applications. The WGS 72 is currently used to define positions for 1-degree DMA DEM's and DTED's. DMA is converting these data to the new WGS 84. The NAD 83 and WGS 84 datums are being phased into the mapping community at different rates or where resources are available. For the conterminous United States these new datums are considered to be functionally the same; however, the two have been defined separately since they were designed to serve different segments of the mapping community, primarily civilian and military. The following information will help clarify the relationship between these datums.

The Role of the Ellipsoid in Defining Datums

Unlike local surveys, which treat the Earth as a plane, the precise determination of the latitude and longitude of points over a broad area must take into account the actual shape of the Earth. To achieve the precision necessary for very accurate location, the Earth cannot simply be assumed to be a sphere. Rather, the Earth's shape more closely approximates an ellipsoid (oblate spheroid): flattened at the poles and bulging at the Equator. Thus the Earth's shape, when cut through its polar axis, approximates an ellipse.

Geodetic surveying, which takes into account variations in the shape of the Earth, is based on a reference ellipsoid to the geoid, the actual shape of the Earth, that is selected as a best fit over a limited area. The ellipsoid used to define a datum is a mathematical surface upon which computation of position can be based, as opposed to the actual surface of the Earth on which surveys are conducted. The geoid, which approximates the sea level surface, is an equipotential surface of the Earth's gravity field. It can be thought of as a continuous sea-level surface extended beneath the continents. It is the "level" surface of reference for astronomic observations and geodetic leveling, but because of undulations that respond to the Earth's mass distributions, it is not a useful computational surface for horizontal surveys.

Horizontal Surveys -- Conversions

NAD 27

The NAD 27 is defined with an initial point at Meades Ranch, Kansas, and by the parameters of the Clarke 1866 ellipsoid. The location of features on USGS topographic maps, including the definition of 7.5-minute quadrangle corners, are referenced to the NAD 27.

NAD 83

Using recent measurements with modern geodetic, gravimetric, astrodynamic, and astronomic instruments, the Geodetic Reference System 1980 (GRS 80) ellipsoid has been defined as a best fit to the worldwide geoid. Unlike NAD 27, which is based on an initial point (Meades Ranch, Kansas), NAD 83 is an Earth-centered datum and uses the GRS 80 ellipsoid. Because the NAD 83 surface deviates from the NAD 27 surface, the position of a point based on the two reference datums will be different.

WGS 72

The definition of DMA DEM's, as presently stored in the USGS data base, references the WGS 72 datum. Like NAD 83, WGS 72 is an Earth-centered datum. The WGS 72 datum was the result of an extensive effort extending over approximately three years to collect selected satellite, surface gravity, and astrogeodetic data available through 1972. The combination of the data was performed using a unified WGS solution (a large-scale least squares adjustment). Such an adjustment was made possible in part because of the availability of adequate computers and software.

WGS 84

The WGS 84 datum was developed as a replacement for WGS 72 by the military mapping community as a result of newer, more accurate instrumentation and more comprehensive control networks. It is an improvement over WGS 72 in several respects. New and more extensive data sets and improved software were used in the development. A more extensive file of Doppler-derived station coordinates was available and for many more local geodetic systems; improved sets of ground-based Doppler and laser satellite-tracking data and surface gravity were available; and geoid heights were deduced from satellite radar altimetry (a new data type) for oceanic regions between 70° north and south latitude (approximately). This system is described in "World Geodetic System 1984," Department of Defense DMA TR 8350.2, September 1987.

DMA has recomputed the 1-degree DTED's for the contiguous United States and has made a copy of the data set available to the USGS.

NAD 27 - NAD 83

The methods available for transformation from NAD 27 to NAD 83 can result in inconsistencies. Therefore, a single method of conversion has been adopted by the USGS. The method involves the use of 7.5-minute grid intersection tables developed by the National Ocean Service and published by the USGS as "North American Datum of 1983," Map Data Conversion Tables, U.S. Geological Survey Bulletin 1875 A, B, and C. Bilinear interpolation of the shifts derived for the four quadrangle corners results in a uniform horizontal translation of values which are applied to all points interior to and including the edges of the quadrangle.

WGS 72 - WGS 84

Tables H-1 and H-2 contain information on converting WGS 72 coordinates to WGS 84. There are no DMA plans to develop WGS 72 coordinates of improved accuracy. However, if WGS 84 coordinates have been determined, the WGS 72-to-WGS 84 formulation in the first table can be reversed and used with the WGS 84 coordinates to obtain improved WGS 72 coordinates.

DEM Datum Identification

The datum applicable to a given DEM data set can generally be determined by the following criteria:

All USGS DEM's lacking the new record A, elements 16-29, are NAD 27.
All DMA DEM's and DTED's lacking datum descriptors are WGS 72.
All DEM's having the new record A elements have datums as indicated in record A, element 28.

Table H1.--Formulas and Parameters to Transform WGS 72 Coordinates to WGS 84 Coordinates--continued

Formulas	$\Delta\phi'' = (4.5 \cos \phi) / (a \sin 1'') + (\Delta f \sin 2\phi) / (\sin 1'')$ $\Delta\lambda'' = 0.554$ $\Delta H_m = 4.5 \sin \phi + a \, \Delta f \sin^2 \phi - \Delta a + \Delta r$
Parameters	$\Delta f = 0.3121057 \times 10^{-7}$ $a = 6378135$ m $\Delta a = 2.0$ m $\Delta r = 1.4$ m
Instructions	To Obtain WGS 84 Coordinates, Add the $\Delta\phi$, $\Delta\lambda$, ΔH Changes Calculated Using WGS 72 Coordinates (ϕ, λ, and H, Respectively). Latitude is Positive North and Longitude is Positive East (0° to 360°).

APPENDIX H.--National and International Datums Used for Digital Elevation Data--continued

Table H2.--Difference Between WGS 84 and WGS 72 Geodetic Coordinates*

	Difference (Meters)		
Degrees	Latitude	Longitude	Height
90 N	0.0	0.0	4.1
85	0.4	1.5	4.1
80	0.8	3.0	4.0
75	1.3	4.4	3.9
70	1.7	5.9	3.8
65	2.1	7.2	3.6
60	2.4	8.6	3.4
55	2.8	9.8	3.2
50	3.1	11.0	3.0
45	3.4	12.1	2.7
40	3.6	13.1	2.4
35	3.9	14.0	2.0
30	4.1	14.8	1.7
25	4.2	15.5	1.3
20	4.4	16.1	1.0
15	4.4	16.5	0.6
10	4.5	16.5	0.2
5 N	4.5	17.1	-0.2
0	4.5	17.1	-0.6
5 S	4.4	17.1	-1.0
10	4.4	16.9	-1.4
15	4.2	16.5	-1.8
20	4.1	16.1	-2.1
25	3.9	15.5	-2.5
30	3.7	14.8	-2.8
35	3.5	14.0	-3.1
40	3.3	13.1	-3.4
45	3.0	12.1	-3.7
50	2.7	11.0	-3.9
55	2.4	9.8	-4.2
60	2.1	8.6	-4.3
65	1.7	7.2	-4.5
70	1.4	5.9	-4.7
75	1.1	4.4	-4.8
80	0.7	3.0	-4.8
85	0.4	1.5	-4.9
90 S	0.0	0.0	-4.9

*Applies only when proceeding directly from WGS 72 coordinates to WGS 84 coordinates; does not contain the effect of the WGS 84 Earth gravitational model and geoid, nor the effect of local geodetic system-to-WGS 84 datum shifts being better than local geodetic system-to-WGS 72 datum shifts.